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Contents for December 25, 1926

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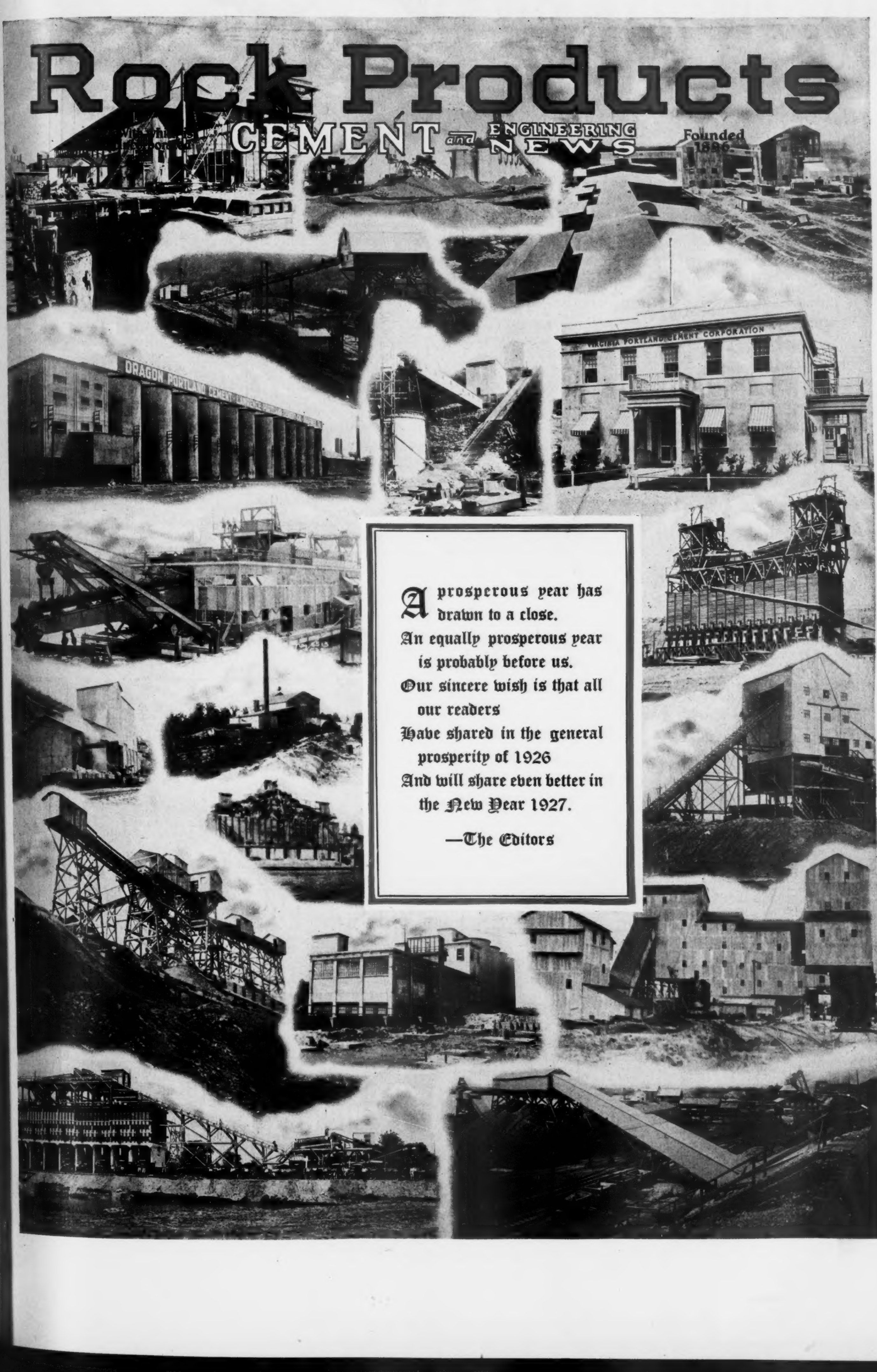


A prosperous year has drawn to a close.
An equally prosperous year is probably before us.
Our sincere wish is that all our readers
Have shared in the general prosperity of 1926
And will share even better in the New Year 1927.

—The Editors

The Year 1926 in Retrospect and the Year 1927 in Prospect

ALL authorities agree that the total volume of business done in 1926 was the greatest ever; and that fundamental business conditions at the beginning of the new year are sound, and that prospects of at least another year of equal business magnitude are promising.

Outstanding facts in connection with the rock products industries are increases in production in 1926 over 1925 ranging from about 2% for portland cement to 15% for sand and gravel; a very general lowering of price levels, as compared with 1925, probably averaging 2 to 4%; a great striving to reduce costs and better the quality in practically all lines; a general tendency to provide producing facilities faster than the demand promises to increase; the development of several local "soft spots," so far as prices are concerned; a rapidly growing recognition of these rock products industries as basic by bankers and leading financial houses.

This recognition of the rock products industries as a field for investment by the general public is based more upon the showing of fair profits over a period of several years than upon the character of the operations, and perhaps will have drawbacks as well as advantages, if it leads to uncalled-for expansion of the industries simply because capital may be more easily obtained.

Bankers and capitalists recognize that portland cement concerns are well managed because they have succeeded as an industry in making profits possible, in spite of tremendous expansion, through effective promotional work, collectively, and individually, by avoiding price-cutting and cut-throat competition. The portland ce-

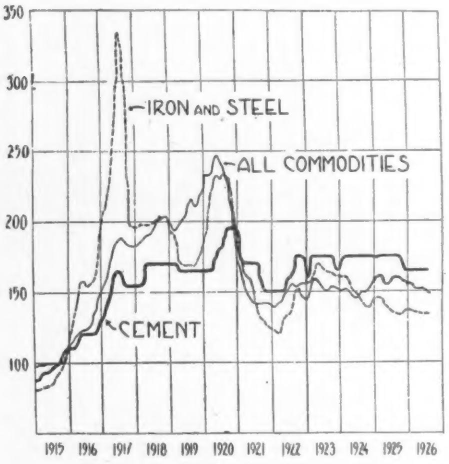
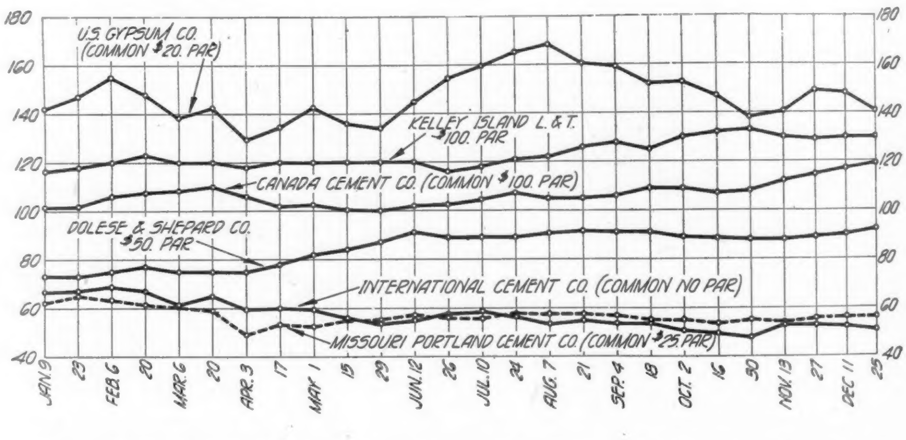


Chart prepared by Mitchell, Hutchins & Co., Chicago, to illustrate relative stability of prices in the portland cement industry



The year's fluctuations in the prices of typical securities in the rock products industries based on current quotations supplied regularly to Rock Products by financial houses

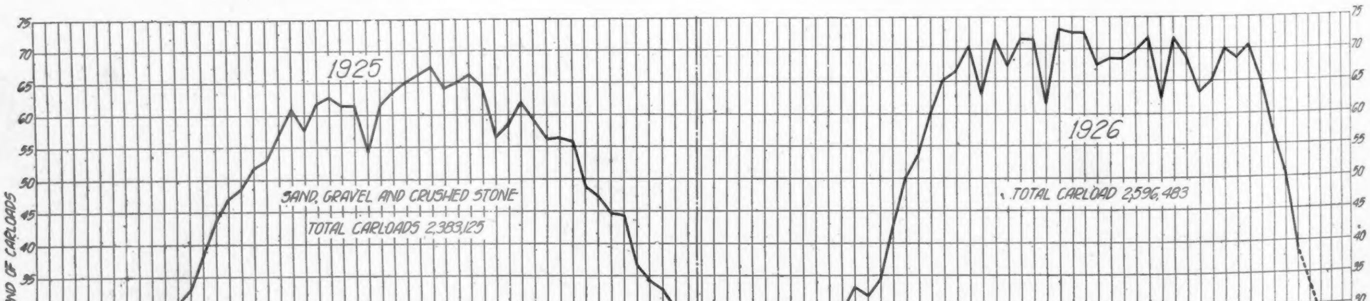


Chart showing weekly car loadings of sand, gravel and crushed stone (and below furnace flux stone) during 1925 and 1926, based on figures furnished Rock Products by the Car Service Bureau of the American Railway Association

ment industry is now ranked by them in the same class with the steel industry—a very high rank indeed.

Some factors which give the portland cement industry this high ranking by bankers are more or less common to all the rock product industries, as will be readily recognized by experienced operators. These factors, according to Mitchell, Hutchins and Co., a Chicago financial house, are:

"(1) Demand stable and largely independent of industrial activity, because diversified among government, farm, building, industrial, railroad and public utility consumers.

"(2) Steady production—no rapid increases or decreases in capacity possible, such as in oil or products of agriculture or mines.

"(3) Negligible danger of obsolescence of modern plants and equipment, as processes are so simple and equipment so developed and standardized that future developments will probably lie principally in refinements rather than in radical changes in the type of equipment used.

"(4) Small size and value of inventories, both of raw materials, which rarely represent more than six weeks' supply, and of finished product, both of which enter rapidly into consumption and are not stocked to any great degree. Raw materials and finished products are standard commodities which keep indefinitely without deterioration."

Therefore, in meeting the competitive conditions of the future, portland cement manufacturers have not only themselves and their individual enterprises to consider, but the ultimate effect of their acts upon the industry as a whole, and upon the public, which has put both faith and money into it as a sound, well-managed industry, upon the recommendation of financial experts.

To a somewhat less degree all other rock products industries are getting to assume the same semi-public character, so that more than ever before there is need for greater knowledge of what constitutes good management, and more and more need for accurate and reliable day-to-day and week-to-week knowledge of statistics and developments in the industry to make all producers good managers.

For the future, the rock products industries, basic and dependent as they are, not on any one business activity but on practically all lines of business activity—for the future—there are nothing but the most favorable prospects, provided only that these industries are well managed. It is educative but not consoling to look back on a year's business, under cut-throat conditions with no profits, and to contemplate that exactly the same amount of business could have been done anyway, and at a fair profit. There are more civilized ways of acquiring an education in management which we hope will be generally followed.

Typical advertisements of a financial house on portland cement securities as an investment for the general public

The Portland Cement Industry in 1926

By Robert W. Lesley
Philadelphia, Penn.

IN his annual address before the Portland Cement Association meeting in Chicago in November of this year, President Blaine S. Smith, dealing with government figures for ten months, estimated that the total shipments of cement for the year 1926 would be about 162,000,000 barrels, or about 3% more than the shipments for the year 1925.

The following table for the 5-year period from 1922 to 1926 inclusive shows the percentage of change in quantity year by year, and it will be noted that the 1926 shipments showed the smallest percentage of gain of any year during the period named.

Per Cent of Change in Quantity of Shipments

1922 over 1921	23+%
1923 over 1922	15+%
1924 over 1923	7+%
1925 over 1924	7+%
1926 over 1925 (estimated)	3+%

Beginning with the year 1921, the per capita consumption of cement in the United States was 0.87 barrels; in 1922 it was 1.06 barrels; in 1923 it was 1.21 barrels; in 1924, 1.29 barrels; and in 1925, 1.40 barrels, showing gains respectively of 0.19, 0.15, 0.8 and 0.11 barrels, while the figures for 1926 will show, according to estimates made, a very small percentage of increase in the per capita consumption.

The year 1926 was in general terms of business a good year, and it is possible only to account for the decrease in percentage of gain by reference to the largely increased imports of portland cement and the increased figures shown for "masonry and natural and Puzzolan cements." As to the imports, this is recognized as a constantly growing evil; while the increased output of natural cement is evidently due to the fact that the manufacturers of this material are turning their eyes to the wide field of brick work and other fields where smooth-working mortars are required, as well as to the constant improvement by scientific methods of the material produced.

In connection with the figures above given by Mr. Smith of estimated shipments for the year 1926, he also states that the capacity to manufacture is continuing to increase, and gives an estimate that, with the additional capacity of new plants built and enlargement of old plants, there will be a capacity in the year 1927 of 215,000,000 barrels, which is 33% greater than the indicated consumption for the year in question. In view of these facts, which experienced manufacturers have been anticipating, a number of new policies, which began in the industry some years ago, now are being continued on a much larger scale.

Envisaging the continuous growth of the industry and recognizing the fact that freight rates on a heavy commodity like cement constitute a large part of the ultimate cost of the material to the consumer, a number

of the older companies, by purchase of existing mills as well as by construction of new ones, have spread their activities over large areas, and in one case even to foreign lands. Among these groups are the Lehigh with twenty plants, the Atlas with six plants, the Alpha with eight plants, the International with twelve plants, the Huron-Wyandotte with six plants, and the Sandusky with its four plants, which have all followed this method.

Within the period between the fall of 1925 and that of 1926 a new means of accomplishing some of the same results by consolidation and sales of securities through banking interests has been used; and two, new, large units of several plants each have been formed under the names of the North American Cement Corporation and the Pennsylvania-Dixie Cement Corporation, the securities of which have been sold throughout the United States to the public at large.

Recognizing still further the principle that the production and marketing of cement is more or less of a "brick-yard proposition," requiring the location of plants near large cities, several of the new plants begun during the year have been located at points like Buffalo, Norfolk, New Orleans, Rockland, Maine, Tampa and Detroit, where water transportation as well as handling by motor trucks direct to the consumers have enabled further economies in transportation to be effected, thus reducing the price of the material delivered to the consumer. While this has been going on, plants in other fields, with more economically produced raw materials, labor skilled in the industry by habit and tradition and more modern machinery have been able in many fields to hold their own in many markets in the face of this increasing production in advantageously located mills.

Therefore, while the new year is likely to open with a surplus capacity of somewhere between 30% and 35%, and imports of portland cement and increased output of natural cement are not likely to decrease, American manufacturers will have to use all their efforts in improved machinery and economy in handling labor to meet the future.

It is not a cheerful thing for the men who upbuilt the portland cement industry in this country to read in trade reports and trade papers that English cement manufacturers, a great number of whom are part of an English trust, are "prospering"; nor is it cheerful tidings to read that in Belgium "there is a heavy demand for cement and the manufacturers are producing at a capacity rate, 50% of the exports coming to the United States." Other cheerful tidings embrace reports of large consolidations of manufacturers in Germany and of renewals of cartel agreements for control of production in various districts. A large combination of manufacturers in Denmark, as well as one in Belgium, is not good news, when the increased amount of foreign portland cement coming to this country is considered by those whose trade is seriously endangered by these imports, especially along the seaboard of the United States.

During the early days of the portland cement industry, from 1886 until the passage of the Underwood tariff bill under the Wilson administration in 1913, the duty on cement was kept practically at a uniform rate of 20 cents per barrel; but after the passage of the Underwood bill, and later of the Fordney bill of 1922, cement, a finished product, was put and kept on the free list,

while pig iron, which like cement in one form or another enters into nearly every industry in our country, and is a semi-finished product only, was made dutiable at 75 cents per long ton.

The American duty on cement was based upon the low wages paid in European industries, compared with what in those years, prior to the war, was paid in American industries. Certainly the comparative figures of the present American wage of $4.50 per day in cement plants, as against 90 cents per day in Belgium, is a clear index of the advantage European manufacturers are now enjoying in markets along the Atlantic and the Pacific coasts. To this advantage in point of cost of production may well be added the enormous advantage in low freight rates from Europe to North Atlantic ports in the United States, as well as to some ports on the Pacific, these freights being really based upon carrying the material as ballast west-bound, in order to get the higher freight prices of the return cargoes of coal, grain, cotton and other raw products of the United States. These rates are so low that it is doubtful whether, under American coastwise shipping conditions, predicated upon the high wages under the LaFollette shipping bill, the seaboard mills can even compete in coastwise markets with the lower costs and lower freights foreign shippers now have. In this connection, by reference to a recent table showing the increase in portland cement production from 1900 of 8,482,020 bbl. to 1925 of 161,202,000 bbl., evidencing as it does the great growth of the American market, it is interesting to note that this great growth, which increased the output from 990,324 bbl. in 1895 to 161,202,000 bbl. in 1925 was in its largest extent produced contemporaneously with the formation of the Portland Cement Association in 1902, and its great development work from year to year. This organization has been an enormous asset to the industry in its scientific work for developing efficient manufacturing processes, in its research in the field of concrete, and its steady development of and propaganda for new uses for portland cement, all of which work has not only helped the American manufacturer, but has also benefitted the foreign manufacturer in widening his market in the United States.

At this time it seems impossible to predict the shipments for 1927. From the best figures obtainable it would seem that there will be a decrease in the construction of small houses and in the smaller building operations; but on the other hand there seems to be no indicated decrease in road construction or large engineering work for 1927, while, with the great efforts that have been made to increase the use of portland cement in concrete products considerable increased demand from this field may be expected.

A Year of Growth and Technical Developments

IN the foregoing article, Robert W. Lesley has emphasized the growing margin between the percentage of increase in portland cement consumption and the percentage of increase in producing capacity, and has shown the relation of portland cement importations to the decreasing rate of growth in the domestic industry. His point may be further illustrated by the following statistics, based on those of the United States Department of Commerce, brought down to date by our estimates. (Shipments — Exports + Imports = Domestic Consumption.)

SHIPMENTS, IMPORTS, EXPORTS AND DOMESTIC CONSUMPTION OF PORTLAND CEMENT, 1919-26 (INCLUSIVE)

	Shipments	Imports	Exports	Domestic Consumption
1919	85,612,899	8,931	2,463,573	83,158,257
1920	96,311,719	524,604	2,985,807	93,850,516
1921	95,507,147	122,322	1,181,014	94,448,455
1922	117,701,216	323,823	1,127,845	116,897,194
1923	135,912,118	1,678,636	1,001,688	136,589,066
1924	146,047,549	2,010,936	878,543	147,179,942
1925	156,724,000	3,655,316	1,019,597	159,359,719
1926*	166,000,000	4,233,000	947,650	169,285,350

*Estimated by editor.

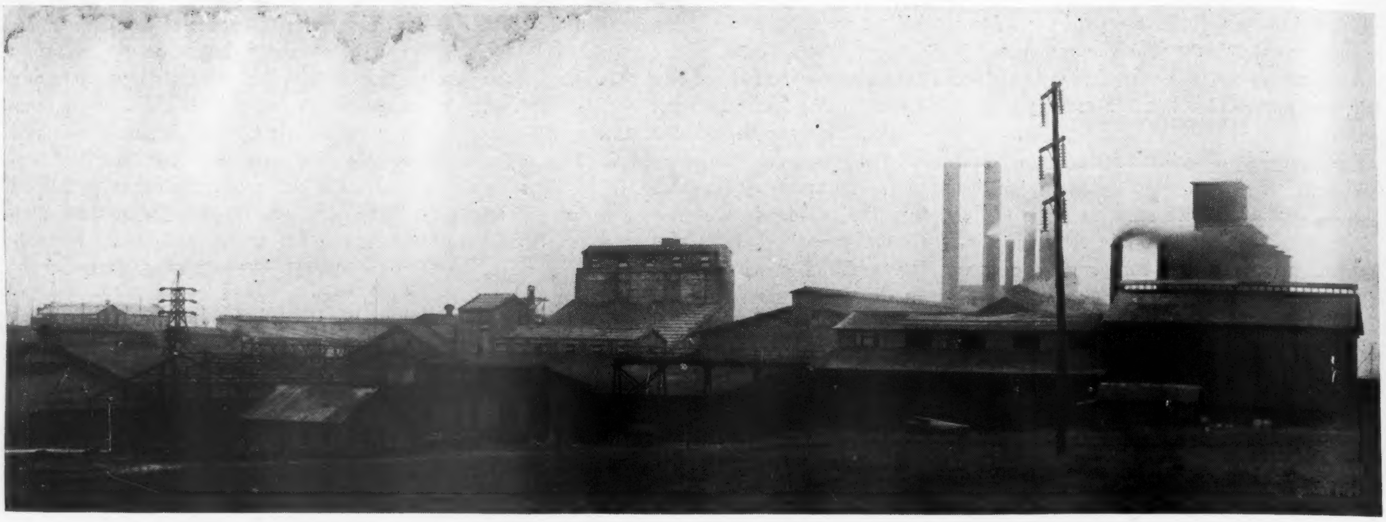
This table shows that while exports of portland cement have remained practically constant (around 1,000,000 bbl. per year), imports have increased from a negligible amount in 1922 to over 4,000,000 bbl. in 1926. Of the steady increase in domestic consumption amounting to about 10,000,000 bbl. a year, since 1923, a constantly increasing percentage is going to imported cement, amounting in 1926 to nearly 50%. With the domestic portland cement industry increasing its productive capacity each year by about 10,000,000 bbl., it is obvious that it will not take many years of progressive increase in plant capacities, and progressive decreases in percentage of the annual 10,000,000-bbl. expected increase in consumption, to have the productive capacity of the American industry 30, 40 or 50% in excess of any reasonable expectation of demand. The estimated producing capacity of the American portland cement industry today is approximately 200,000,000 bbl., or something less than 25% in excess of the 1926 consumption. It is expected that by the end of 1927 the producing capacity will be 215,000,000 bbl., which with a possible consumption of something like 170,000,000 bbl. is a prospective excess of producing capacity of nearly 30%.

Production, Prices, Plant Capacities

Reports from a group of representative producers give the following data: 64% of those reporting increased their production in 1926 averaging about 15% over 1925; 32% reported decreases in production as compared with 1925 of an average of 19%. One per cent. had no change in production. Weighing these percentages, the increase in production averaged 2%, as compared with 1925, or an estimated increase of 3,200,000 bbl. From the figures of the U. S. Department of Commerce recently made available including November, and with December estimated at the same figure as for last year, we have the approximate production of portland cement in 1926 as 163,765,000 bbl., compared with 161,202,000 bbl. in 1925, an increase of approximately 2,503,000 bbl., or 1½%.

In no instance was there a reported increase in average selling price in 1926 as compared with 1925, although 18% of those reporting said prices were approximately the same as in 1925. The remaining 82% reported decreases in prices ranging from 2 to 13%, with an average of 4½%. Taking into account those who reported prices unchanged, we have an average decrease in prices for the industry as a whole of 3¾%. Since the average net mill selling price, based on Department of Commerce reports, in 1925 was $1.807 per bbl., the approximate average selling price in 1926 was 6¾c less, or $1.74. (The price charts accompanying this article are based on quotations in the principal cities and not on the net mill prices. The chart showing mill prices is made up of the quotations of a few mills only, and of course does not take into account discounts, losses, etc., which always bring down the actual price realized on a year's output.)

The capacity, or manufacturing facilities, of existing plants in the industry were quite generally increased during 1926. Of those reporting 50% increased their plant capacities during 1926 in percentages ranging from 4 to 50%, with an average of 21%; the other 50% reported no change in plant capacities, giving an average for the entire group of about 10%. This does not take into account new production from entirely new plants. A list of the improvements by which this 10% increase in plant capacity was accomplished includes such items as: (1) additional water supply, additional engine and generator, new silos, 180,000 bbl. capacity; (2) entire reconstruction of plant; (3) limestone and clinker storage; (4) electrical equipment changed over from 25 to 60-cycle; (5) general improvements; (6) waste-heat boiler installation; (7) new packing house and bag house; (8) rock-storage plant; general improvements; (9) flue-dust recovery system; (10) electric power in



Recent view of the Coplay Cement Manufacturing Co. plant at West Coplay, Penn.

quarry; (11) miscellaneous; (12) one additional kiln; one additional grinding mill, improvements in existing mill to increase their capacity, increased stone storage; (13) electric quarry operation, improvements in raw grinding and clinker handling; (14) additional kiln.

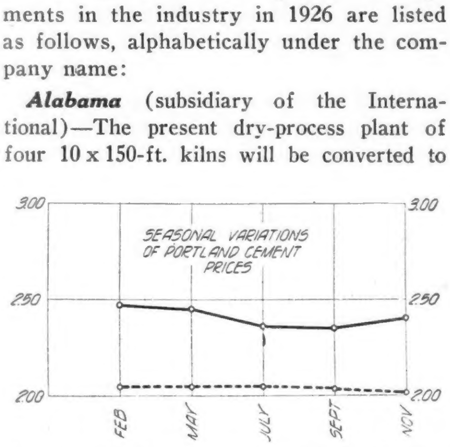
The above list is typical of the character of improvements, taken direct from reports of producers, showing how plant capacities are constantly being increased and greater efficiency attained.

The same group reported contemplated increases in manufacturing facilities in 1927 as follows: 50% are planning improvements to increase plant capacities ranging from 10 to 100%, with an average of 24%; 50% of the producers are planning no increases. Therefore proposed facilities for increased production in 1927 averaged 12% of the existing facilities from the group of plants reporting. Typical improvements contemplated are listed as follows: (1) Dust collection in packing houses; (2) completion of plant reconstruction; (3) new concrete silos, improved shipping facilities and better provision for raw mixing; (4) rebuilding raw material buildings and rock-crushing plant; (5) "minimum alterations"; (6) general plant improvements including two new kilns and waste-heat boilers, two steam turbines, a new 100,000-bbl. silo storage; (7) miscellaneous; (8) six new silos for cement storage, and bag house; (9) additional kiln, additional grinding machinery and storage capacity; (10) new crushing department and crushed rock storage.

Significant Developments

Some of the most important developments in the industry in 1926 are listed as follows, alphabetically under the company name:

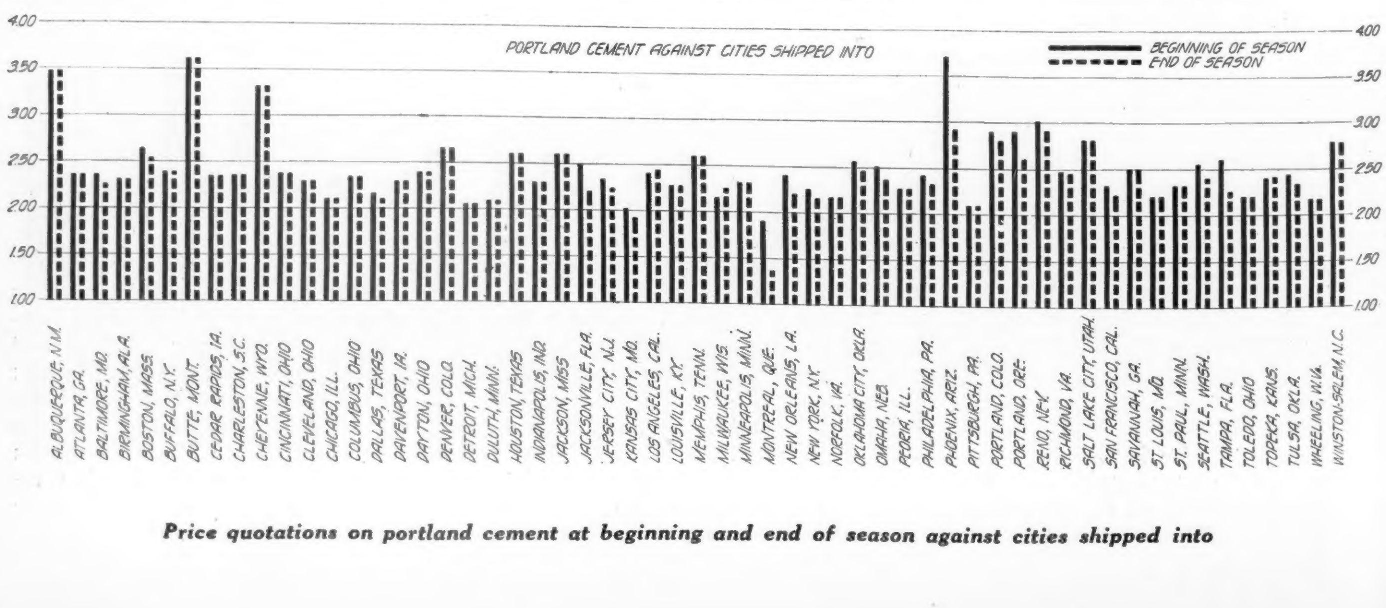
Alabama (subsidiary of the International)—The present dry-process plant of four 10 x 150-ft. kilns will be converted to wet-process, including lengthening the kilns. This is particularly significant as this plant, completed by the Phoenix Portland Cement Co. in 1923, was the first dry-process plant built in this country in several years, and has been held up (see ROCK PRODUCTS, August 25, 1923) as a star exhibit of the survival of the dry process.



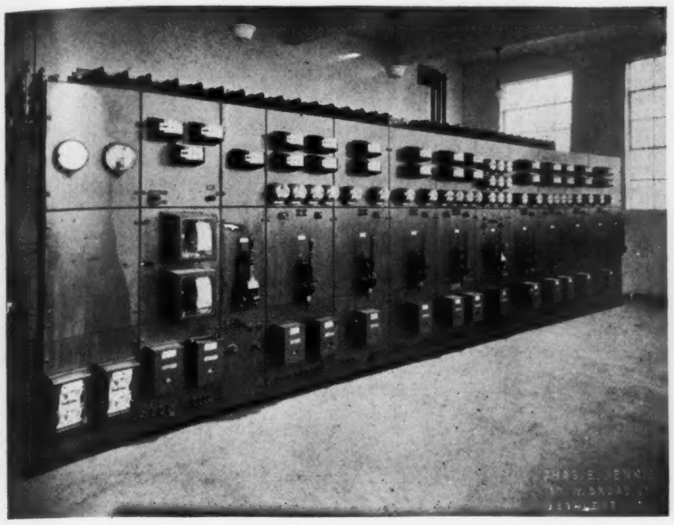
Seasonal change in portland cement quotations — Above, average at different cities, and below, mill prices

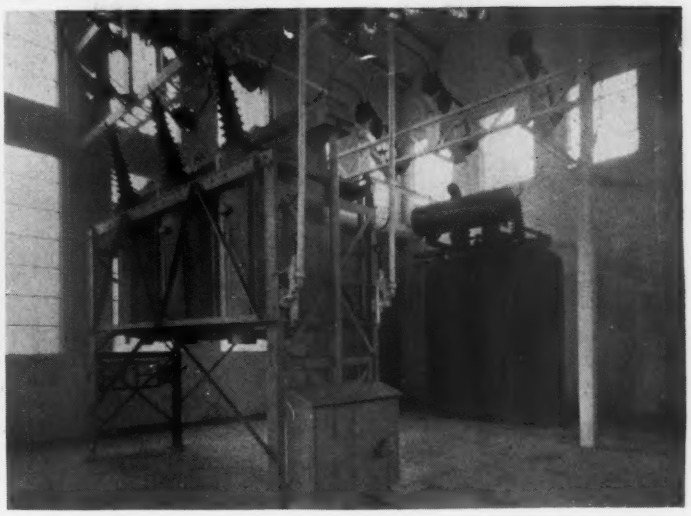
Alamo — The San Antonio Portland Cement Co., San Antonio, Tex., is adding a third 10 ft. by 9 ft. by 220 ft. kiln to its plant near San Antonio, Tex. Other improvements include a new clinker storage, new office, and other accessory buildings. (Capacity increased from 2000 to 3000 bbl. daily—300,000 bbl. per year, our estimate.)

Alpha—The new packhouse and silos at Martin's Creek, Penn., were completed in 1926, and are shown in some of the accompanying illustrations. This is typical of the transformations in progress at the older plants in the Lehigh Valley. The new silos have a capacity of 275,000 bbl. Eight new 4-valve Bates packing machines, added to the packers in the old warehouse, give this plant a packing capacity of 12,000 bbl. per day. The use of 4-valve machines at cement plants is unusual, the 3-valve machine being the one more commonly installed.



Price quotations on portland cement at beginning and end of season against cities shipped into





Electric switchboard (left) and transformers (right) at the Coplay Cement Manufacturing Co.

Atlas—Completed and put in operation its own mine and crushing plant for gypsum at Clarence Center, N. Y.

Beaver—Constructing its own hydro-electric power plant, Gold Hill, Ore.

Bessemer—A new system of cooling cement, utilizing Sly dust collectors was installed. It consists of a baffled chute from the tube mill discharge to the screw conveyor below, the chute being cooled by air drawn through it to the dust collectors.

Calaveras—The Calaveras Cement Co. completed a new wet-process plant at San Andreas, Calif., in the spring. This plant was financed, designed and built by well-known mining engineers, and is operated by them. Because of the similarity of many cement manufacturing processes to mining and metallurgical practice this plant is of more than ordinary interest and its operation will undoubtedly prove of more than ordinary interest. As we shall have a complete description of this plant in a later issue, we will refer here to only a few outstanding features.

Following mining practice the deposits of limestone and shale probably have been more thoroughly explored than any similar deposits elsewhere. Twenty-ton quarry cars are discharged to a 42-in. gyratory crusher by means of a rotary car dumper. The kilns are 11 ft. 3 in. by 10 ft. by 240 ft., fired with oil. What cement experts who have visited the plant say is the most complete system of slurry control ever devised has been installed. Indeed the plant throughout shows that the wide knowledge gained by the builders in the mining and metallurgical field has been applied in a way that will prove interesting and helpful to other cement manufacturers. The operation of the plant since its opening on May 29 has proved it can produce a very high quality of cement.

The plant was built and equipped by the Allis-Chalmers Manufacturing Co. after designs by William Wallace Mein, president; Stuart L. Rawlins, vice-president, and George B. Poore, vice-president. William Macnider is sales manager. Mr. Mein is a mining engineer of world-wide fame and experience, with interests in South Africa, South America and elsewhere. The other executive officers are also mining engineers. Mr. Macnider is a nephew of C. H. Macnider, president of the Northwestern States Portland Cement Co., Mason City, Iowa. The few illustrations herewith are only a sample of what will accompany the article to be published soon.

Canada—Plant No. 7 at Lakefield, Ont., which prior to 1914 was operated on marl and clay is being remodeled and largely rebuilt to adapt it to the use of limestone and shale, both of which are found on the company's property close to the mill site. The dry process will be used with nine 7 x 100-ft. kilns. The grinding will be done with ball mills and tube mills. A hydro-electric power plant is being built on the Atonabee river about a quarter of a mile from the cement plant to furnish power for its operation.

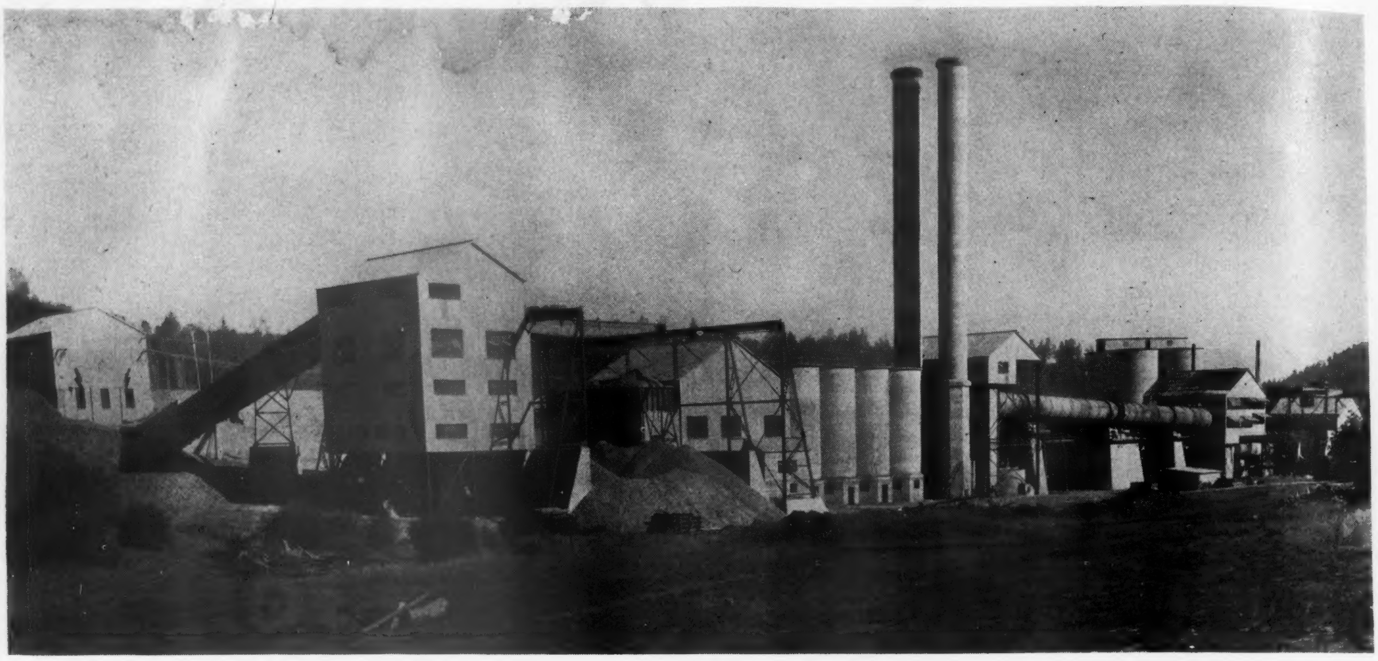
Coplay—The 1927 building program will include a 28-bin concrete silo storage, together with a packhouse having a packing capacity of 12,000 bbl. per day; also the installation of eight raw rock mixing silos. Concrete placing on these will be carried on through this winter. During 1926 the company scrapped all of its steam locomotives and replaced them with 16-ton Vulcan gasoline locomotives for handling the heavy haulage and 8-ton Vulcan locomotives for handling the quarry cars. The maximum grades were reduced to 2% and hauls average eight 5-ton cars.

Ford—An article elsewhere in this issue describes the first installation in the portland cement industry using American filters for de-watering the slurry before feeding it to the kilns. The Ford plant has also been completely equipped with dust collectors and air-conveying systems for handling both raw materials and cement, by the Dust Recovering and Conveying Co., Cleveland, Ohio, as will be described in detail in a forthcoming issue. This installation includes the utilization of waste-heat recovered from kiln radiation for coal drying.

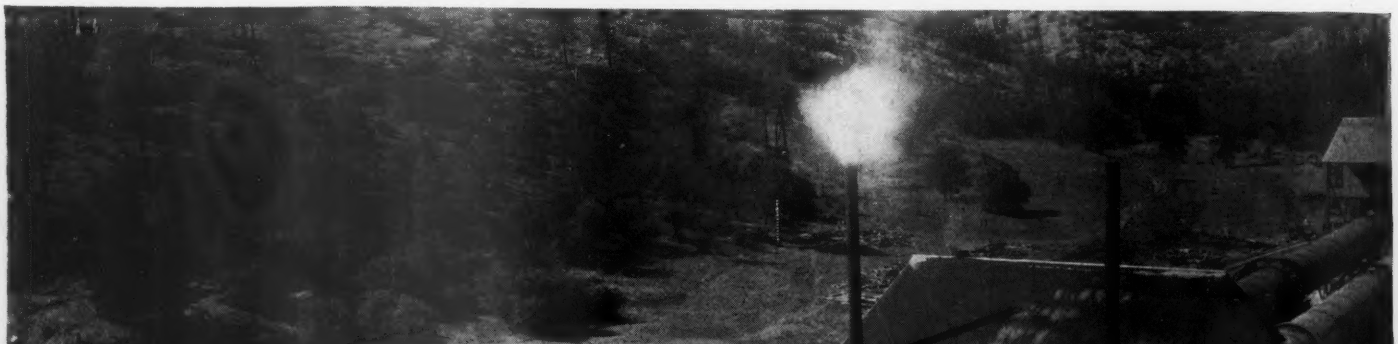
Giant—The practical rebuilding of the plant at Egypt, Penn., was described in detail in ROCK PRODUCTS, June 26, by D. C. Finlay.

Glens Falls—Some of the improvements completed at this plant are illustrated herewith. They include a new concrete silo storage and packhouse and a new coal mill with novel features. The packhouse is equipped with F. L. Smidth & Co. "ex-biners" and the coal mill has one of the two American installations of Smidth "pyrators" for coal

New transformer station at the Coplay company's mill



Calaveras Cement Co.'s recently completed plant at San Andreas, Calif.

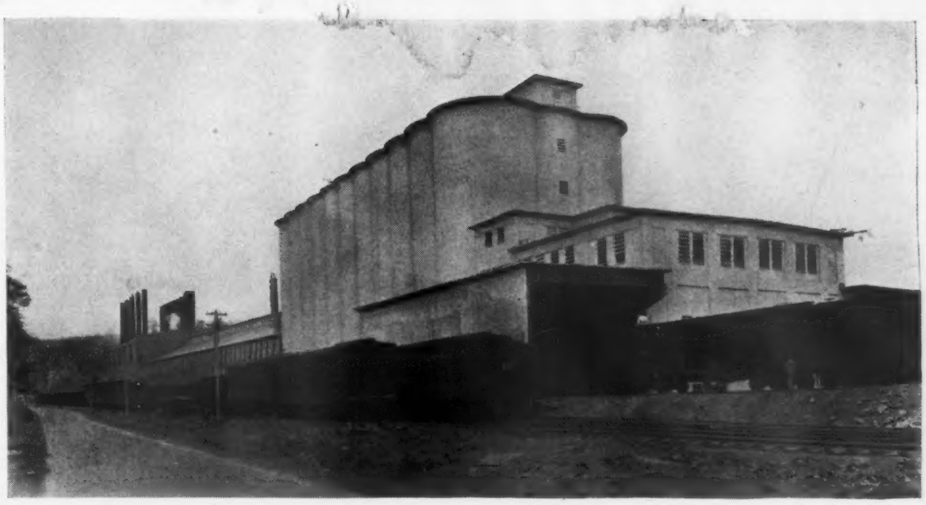


Clinker discharging to storage at the Calaveras Cement Co. plant

drying. In this system of coal drying chilled cast-iron balls are heated in an outside furnace and circulate through the furnace and the grinding mill. There is a screening arrangement between the first and second compartments of the pyrator, or combined mill and dryer, which permits the coal that has been ground in the first compartment to pass through and be carried by lifting arms into the second compartment, where it receives its final grinding. The balls, instead of passing through the screens, find their way into discharge openings through which they are returned to the ball furnace for re-heating. After leaving the pyrator the coal is transferred to the kiln bins by Fuller-Kinyon pumps.

Gilmore — This plant at Gilmore City, Iowa, purchased early in the year by C. H. Macnider, president of the Northwestern States Portland Cement Co., Mason City, Ia., is being completely overhauled, improved and enlarged.

Kosmos — Extensive improvements have been made in the coal mill and during 1927 a new 8 x 35-ft tube mill will be installed with a new type of direct synchronous motor drive, known as the "Hytork" in which no clutch is required. This installation is being made by the Allis-Chalmers Manufacturing Co.



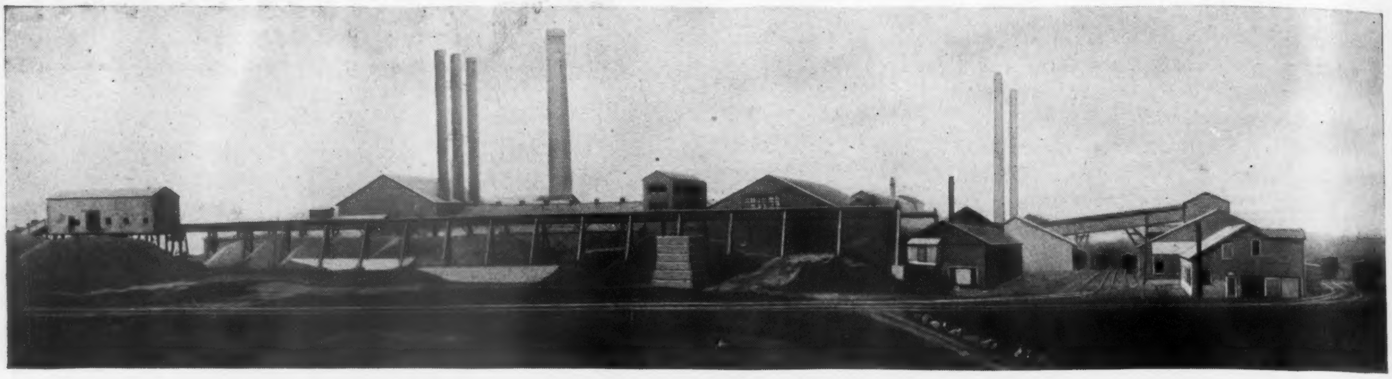
New packhouse and storage silos at Martins Creek, Penn. plant of the Alpha Portland Cement Co.

Lawrence—The plant at Siegfried, Penn., has been much improved and enlarged. These changes were described in ROCK PRODUCTS, September 4. More details of the changes at this plant will be described in a forthcoming issue.

Lehigh—The most important development by this company in 1926 were the completion of the Sandt's Eddy (Penn.) plant and the acquisition of a large interest in the Great Lakes Portland Cement Co. plant, now building. The Sandt's Eddy plant, the first wet-process plant in the Lehigh Valley, operating on natural cement rock, was described in detail in ROCK PRODUCTS, August 7 and August 21.

Louisville — Improvements and additions are being made to the rock-crushing plant, including the installation of a No. 24 Allis-Chalmers type K gyratory crusher and a

Airplane view of the rebuilt plant at Fredonia, Kan., of the Consolidated Cement Corp.



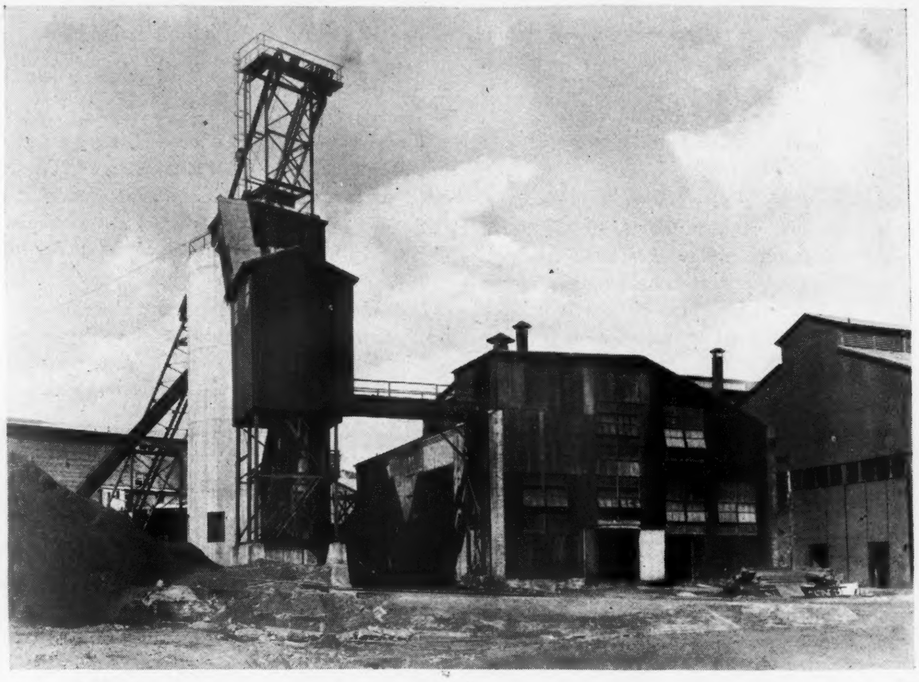
Consolidated Cement Corp. plant at Cement City, Mich., showing recent improvements

large size Pennsylvania hammer mill. Also extensive improvements are in progress in the coal-grinding department, including the installation of three 8 x 70-ft. coal dryers, with direct-connected motor drives.

National (Canada)—The plant completed late in 1925 at Montreal is being enlarged by the addition of a fourth kiln 9 x 160 ft. (dry process).

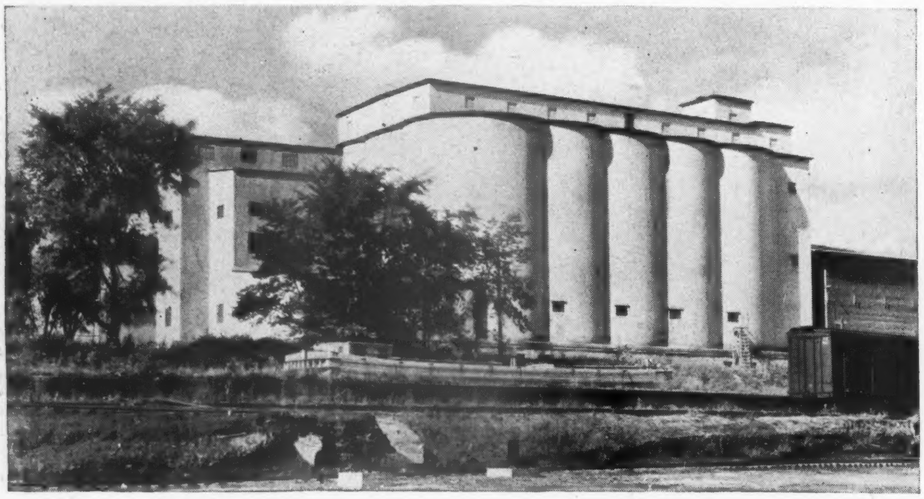
Nazareth—The fine new laboratory of this company was described in detail in Rock Products, October 2, by Edward E. Dreisbach, head of the company's research department. It is a good example of the development of the chemical and research work being rapidly adopted by progressive portland cement manufacturers to perfect their product and serve their customers.

New Egyptian—A new concrete silo storage (250,000 bbl.) and a four-story reinforced-concrete packhouse have been built in 1926. The Fuller-Kinyon system is used for handling the cement from mills to storage and Sly dust collectors are installed on baggers and bag cleaners. Cement is removed from the silos by a traveling Fuller-Kinyon pump to a 100-bbl. settling bin on the top floor of the packhouse, from which it is distributed by screw conveyors and spouts to the packers.



New coal mill of the Glens Falls Portland Cement Co., Glens Falls, N. Y.

North American—At the Howe's Cave plant a new crushing plant has been put into operation, also an additional tube mill on the raw end, a new kiln, equipped with the first American installation of the F. L. Smidth & Co. "unax" cooler, one 10-ft. Hardinge conical mill on the finishing end and a waste-heat boiler plant with two Ladd boilers. At the Catskill plant (the old Acme plant) a new crushing plant has been built, new stone, clinker and coal storage handling systems, one new kiln has been added, an entirely new installation of raw and finish mills have been completed and a waste-heat boiler plant with two Babcock and Wilcox boilers has been constructed. The capacity of the various plants of this company has been increased from 2,700,000 bbl. to 4,700,000 bbl. annually.

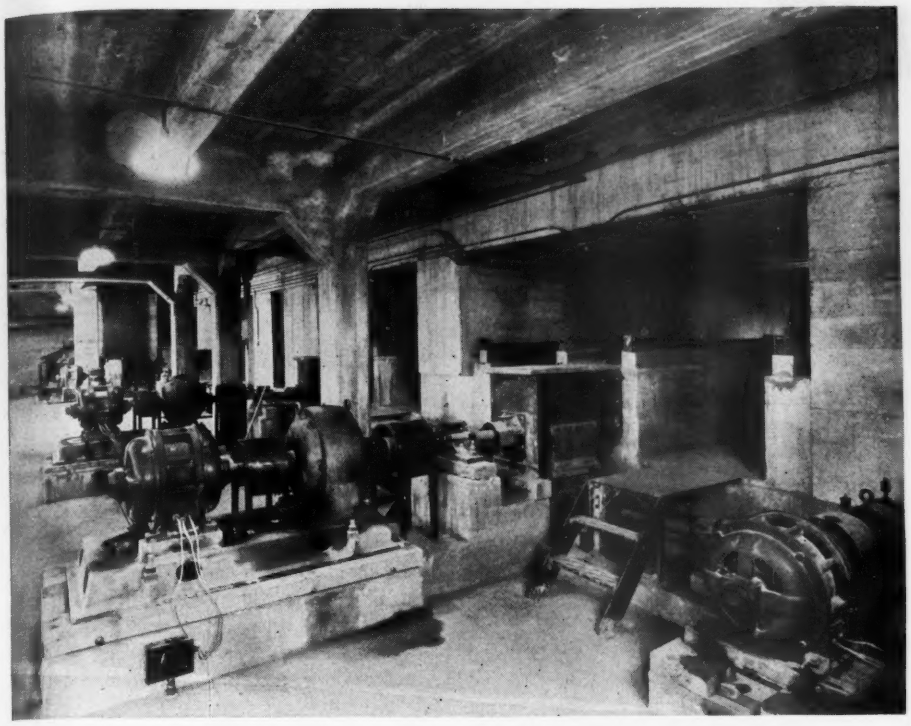


New concrete storage silos for cement at Glens Falls Portland Cement Co.

Old Mission—Development work about to be undertaken includes the construction of a 5-mile aerial tramway for handling stone.

Pacific—Work has already started on the construction of the second unit of the Redwood City plant. Two new kilns, 11 ft. 3 in. by 10 ft. by 235 ft. are to be added with the necessary new grinding machinery. This will bring the capacity of the Redwood City plant to about 5,500 bbl. per day.

Pennsylvania-Dixie—Extensive additions and improvements to the Dixie plant at Richard City, Tenn., are still in progress. The modernization of the electrical equipment, the new raw grinding department, and other details were described in detail in Rock Products, March 20. Two new kilns 11 ft. 3 in. by 10 ft. by 343 ft. are now being installed. The Portland (N. Y.) plant is



View under the silos at the Glens Falls Portland Cement Co. plant

ville (Calif.) plant. Late reports state another kiln will be added in 1927 to the plant at Osborn, Ohio, which now has three 11 ft. 3 in. by 10 ft. by 175 ft. (wet-process waste-heat) kilns.

Universal—Nine concrete silo storage bins were built in 1926 at the Duluth (Minn.) plant, increasing the storage capacity by about 100,000 bbl., or to a total of about 550,000 bbl. A new packhouse and bins at the Universal (Penn.) plant are nearly completed. Plans are under way for the construction of an entire new plant at Cleveland, Ohio.

Virginia—The plant of the Virginia Portland Cement Corp., a subsidiary of the International Cement Corp., at Norfolk, Va., went into full production the first of the year. It was fully described in Rock Products, April 17 (1,200,000 bbl. per year capacity).

Wabash—The new Osborne (Ohio) plant of this company went into production early in the year. It has two kilns (wet-process) 11 ft. 3 in. by 10 ft. by 175 ft. (2,500 bbl. daily). A description of this plant will be published in a later issue.

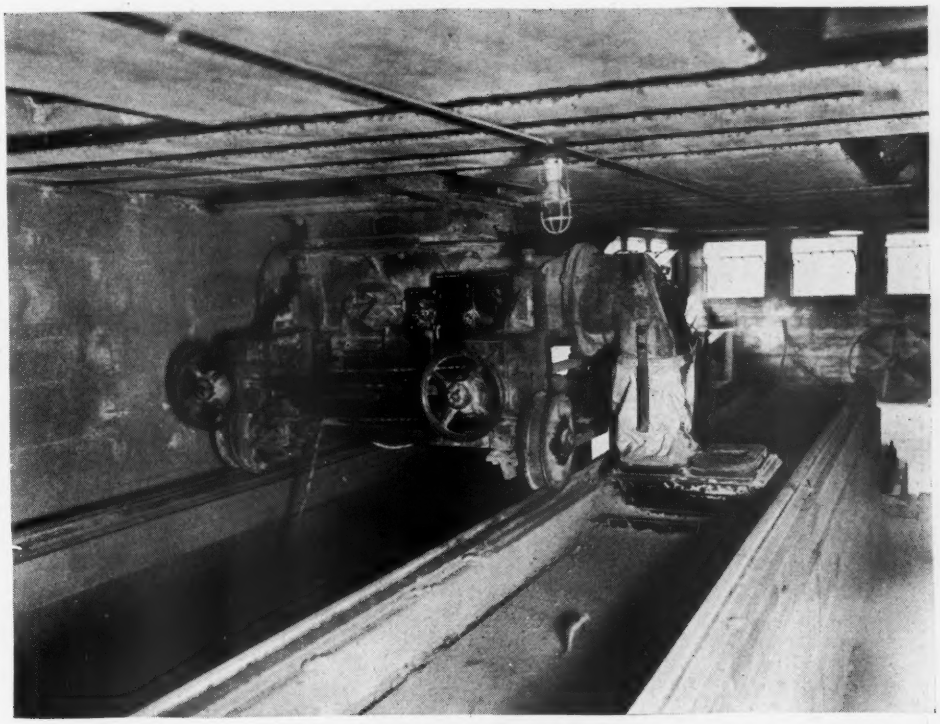
Warrior—The company's coal mine at Ivy

being rehabilitated with new machine shop, packing plant, storage, etc.

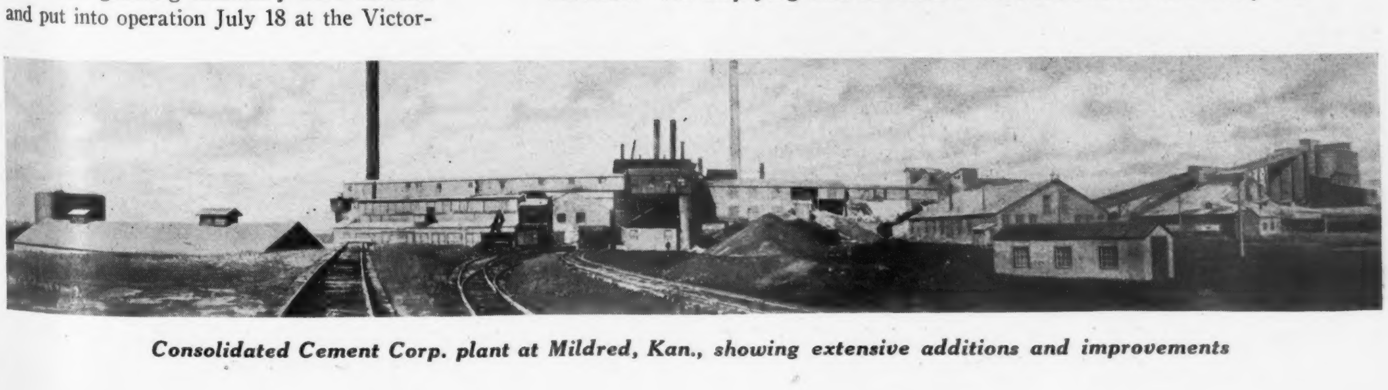
Santa Cruz—Six new kilns (7½ x 125-ft. dry-process) increasing the capacity of the plant from 10,000 to 14,000 bbl. per day are being installed, with additional grinding equipment. A description of this plant was published in Rock Products, September 18.

Signal Mountain—The expansion program completed in 1926 includes additional capacity in the crushing department through the installation of a No. 6 Williams mill, extension of the main storage building, increasing the raw storage by 15%; six new concrete silos (100,000 bbl.), a Fuller-Kinyon system for handling the cement; the installation of a third kiln 11 x 175-ft. (wet-process) increasing the capacity from 1,000,000 to 1,500,000 bbl. per year; two new Compeb mills (7 x 36 ft.) on the raw end and two on the finish end. Various other improvements have been made in the quarry and plant structures. A waste-heat boiler plant is contemplated in 1927. The Cowham Engineering Co., Chicago, are the engineers.

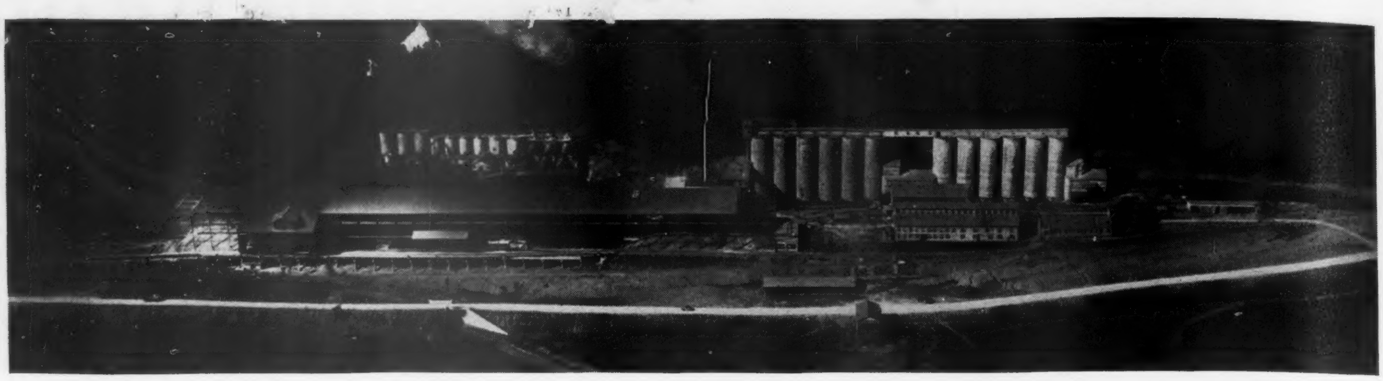
Southwestern—A fifth kiln (10 ft. 6 in. by 9 ft. by 200 ft. wet-process) and additional raw grinding machinery were installed and put into operation July 18 at the Victor-



"Ex-biner" for emptying bins at Glens Falls Portland Cement Co. plant



Consolidated Cement Corp. plant at Mildred, Kan., showing extensive additions and improvements



Signal Mountain Portland Cement Co. plant at Chattanooga, Tenn. The third kiln and new silos recently added are shown

Bluff, Ala., has been converted to electric operation. New warehouses at Mobile and New Orleans are nearing completion. The rebuilding of the plant is progressing rapidly. One new wet-process kiln (10 x 150 ft.) is practically ready to operate and the second is expected to be ready by February 1. There are two old kilns operating on the dry process. The changes will double the capacity of the plant (500,000 to 1,000,000 bbl.).

Plants Under Construction and Projected

The following are so far as we know at this writing live projects and plants actually in the course of construction. Various alleged new projects mentioned in our news items during the past year have been eliminated from this general summary.

Basic—A recent announcement by A. T. Wood, general manager of the Basic Products Co., in the local press, states that this company's rotary-kiln lime plant at Kenova, W. Va., is being reconstructed to manufacture portland cement, and it is stated the cement plant will be in production by March 1, 1927 (600,000 bbl.).

Consolidated—Rockland, Me., project for 1,500,000-bbl. plant. Some preliminary work has been done, but actual construction of the plant has not been started.

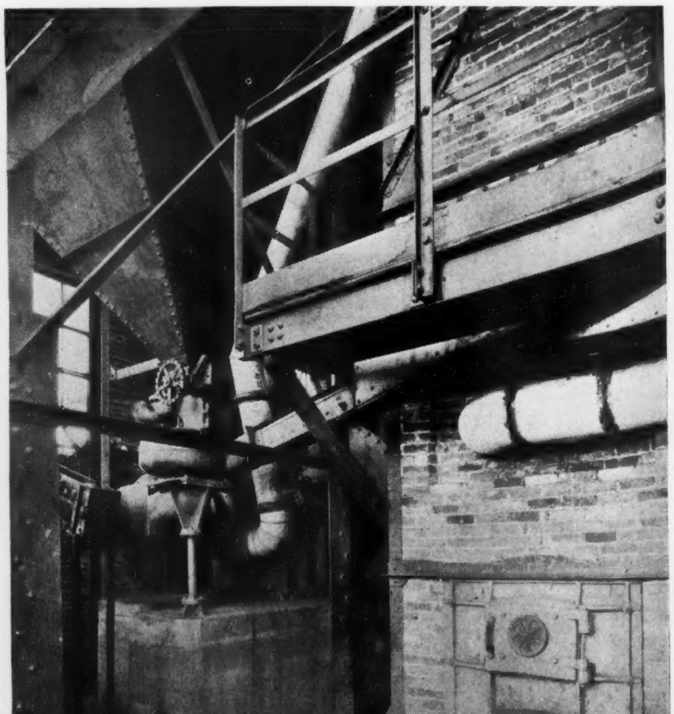
Cumberland—Recent reports state that ground was broken for construction of this plant at Cowan, Tenn., on June 10 and that the plant is expected to be in operation about March 1, 1927. It was promoted and financed by Nashville business men, and it is intended to manufacture 2,000 bbl. per day of white cement (600,000 bbl. annually).

Dayton—The Dayton Portland Cement Co., Dayton, Ohio, is in a formation stage; financing is stated to be about complete; engineering plans and specifications have been prepared, and construction work is expected to begin on the property owned by the company at Germantown, Ohio, soon. (600,000 bbl. annually—our estimate.)

Dewey—This company's new plant at Davenport, Iowa, is well under way, and is expected to be ready to operate in the early spring. (1,000,000 bbl. annually.)

Florida—Construction work is progressing on the plant at Tampa. The contract for the piling has been completed. An 800-ft. dock and 500 ft. of bulkhead have been com-

"Pyrator" installation in new coal mill of the Glens Falls Portland Cement Co.



Another view of pyrator installation at Glens Falls Portland Cement Co.

pleted. Foundation work for the mill buildings and machinery has been done. It will be a wet-process, waste-heat plant with three 11 x 175-ft. kilns and an initial capacity of 1,500,000 bbl. (Cowham Engineering Co.).

Georgia—This is a new company—the Georgia Portland Cement Co.—and a contract was recently let to the H. K. Ferguson Co., Cleveland, for the design and construction of a two-kiln wet-process plant at Sandersville, Ga. Its initial capacity will be 1,000,000 bbl.

Great Lakes—Construction work is well advanced on the 6,000-bbl. plant at Buffalo, N. Y. There are to be four kilns 11 x 250 ft. with 9 x 90-ft. coolers. The raw grinding mills (wet) are 8 x 30 ft. and the finish mills are the same size—each driven by a super-synchronous motor. The equipment is all purchased and on the ground and much of the structural work is done. The plant is expected to operate soon after the first of the year. Its product will be sold under the Lehigh brand.

Federal—Construction work on the Buffalo (N. Y.) plant of this company is well advanced. It will use the wet process with slag and limestone as the raw materials. American filters similar to those at the Ford plant are being installed to de-water the slurry. The two kilns are 11 x 175 ft. The initial capacity is to be 3,000 bbl. daily. The Federal Portland Cement Co. also has a project to build a plant at Cleveland, which seems to be dormant at this writing.

Ideal—The Boettcher (Colo.) plant of this company is nearing completion, and will probably be in production in the early spring. This is to be a dry-process operation with two 11 x 175-ft. kilns—the first dry-process plant to be built in the United States since the Phoenix plant at Birmingham in 1923. (The latter is now being converted to wet-process, as already noted.) This plant will be an unusual operation in other respects. The quarry shovel is a 125-ton revolving electric shovel on crawler treads. It is to be a waste-heat plant. Fuller-Kinyon pumps will be used to handle both raw material and finished cement. Its rated capacity is 1,000,000 bbl. per year.

Keystone—This company has been organized to build a plant at Bath, Penn. No further announcements have been made since our issue of October 2, when John M. Buckland, president of the company, and also of the National Slag Co., told one of the editors of Rock Products the plant would be built as a wet-process operation with an initial capacity of 1,000,000 bbl. annually.

Lawrence—The Lawrence Portland Cement Co., Northampton, Penn., has acquired a controlling interest in the Rockland (Me.) project for a cement plant by the New England Portland Cement and Lime Co. It is reported that a cement plant will be built in the near future using the wet process, and of about 1,000,000 bbl. annual capacity.

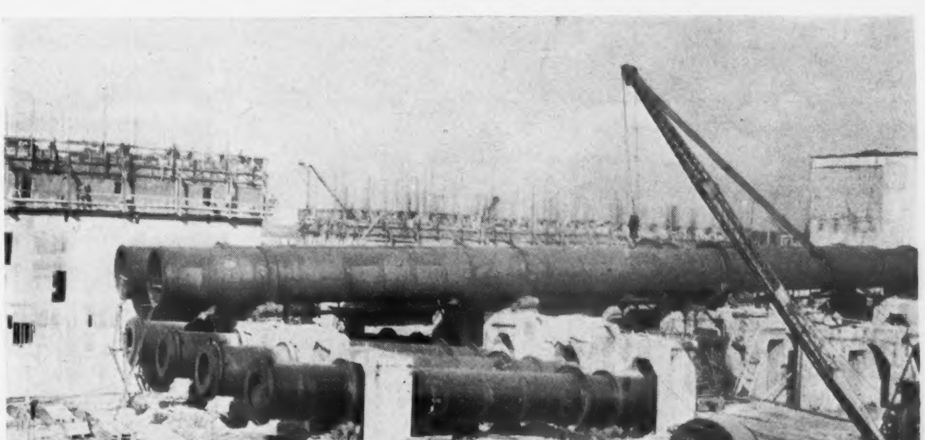
Lehigh—There has been no recent announcement from this company in respect to its project to build a new plant at Ocala, Fla., where the company owns property with suitable raw materials (formerly the Ocala Portland Cement Co.).

Louisiana—The plant being built at New Orleans, La., for the Louisiana Portland Cement Corp., a subsidiary of the International Cement Corp., is well advanced toward completion. It should be ready to produce in the spring or early summer. It will have two 8 x 9 x 217-ft. kilns (wet process) with an initial capacity of about 1,000,000 bbl. yearly.

Mississippi—The project of the Mississippi Portland Cement Co. to build a plant or

General view of the Great Lakes Portland Cement Co. plant under construction near Buffalo, N. Y.

Plant structures on the Great Lakes company's mill site



Two of the four kilns and their cooler sections in place at the Great Lakes mill

plants somewhere in Mississippi is still in the promotional stage.

Missouri—The Missouri Portland Cement Co., St. Louis, Mo., contemplates a new wet-process plant near Batesville, Ark., where it has acquired more than 1,000 acres of property containing the necessary raw materials. (Estimated capacity 1,000,000 bbl.)

Northwestern—A recently incorporated company in Washington State, the Northwestern Portland Cement Co., has acquired 635 acres of property at Grotto, Wash., and, according to the latest press dispatches, has already broken ground for the construction of a 1,500-bbl.-a-day wet-process plant (750,000 bbl. per year).

Phoenix—The Phoenix Portland Cement Co.'s plant at Powderly, near Birmingham, Ala., is nearing completion and should be ready to produce early in the new year. It is a wet-process plant with two 11 ft. 3 in. by 330 ft. kilns and 7 x 40-ft. mills. It is constructed of reinforced concrete throughout. (Estimated yearly capacity 1,300,000 bbl.)

Santa Rosa—Contracts for the design and construction of the projected plant of the newly-organized Santa Rosa Portland Cement Co. at St. Stephens, Ala., were let in June to the H. K. Ferguson Co., Cleveland, Ohio. We have no report that construction has yet started. It is planned to build a two-kiln plant on the wet process with an initial capacity of about 1,000,000 bbl.

Trinity—The Trinity Portland Cement Co. acquired property for a projected new plant at Houston, Tex. Premature newspaper announcements stated the plant would have four 11 ft. 3 in. by 300 ft. kilns (wet process) and have a daily capacity of 6000 bbl., although only one kiln was to be installed at first. Construction work has not been started.

Universal—A new plant at Cleveland, Ohio, is projected (1,000,000 bbl.) by the Universal Portland Cement Co., as already noted.

Valley—A new California incorporation, the Valley Portland Cement Co., Three Rivers, Calif., has been reported as acquiring options on property and prospecting for limestone and shale.

Washington—A new project organized in Washington State under the name of the Washington Cement Co. is in the progress of financing and promotion. A 750,000-bbl. plant is proposed near Seattle.

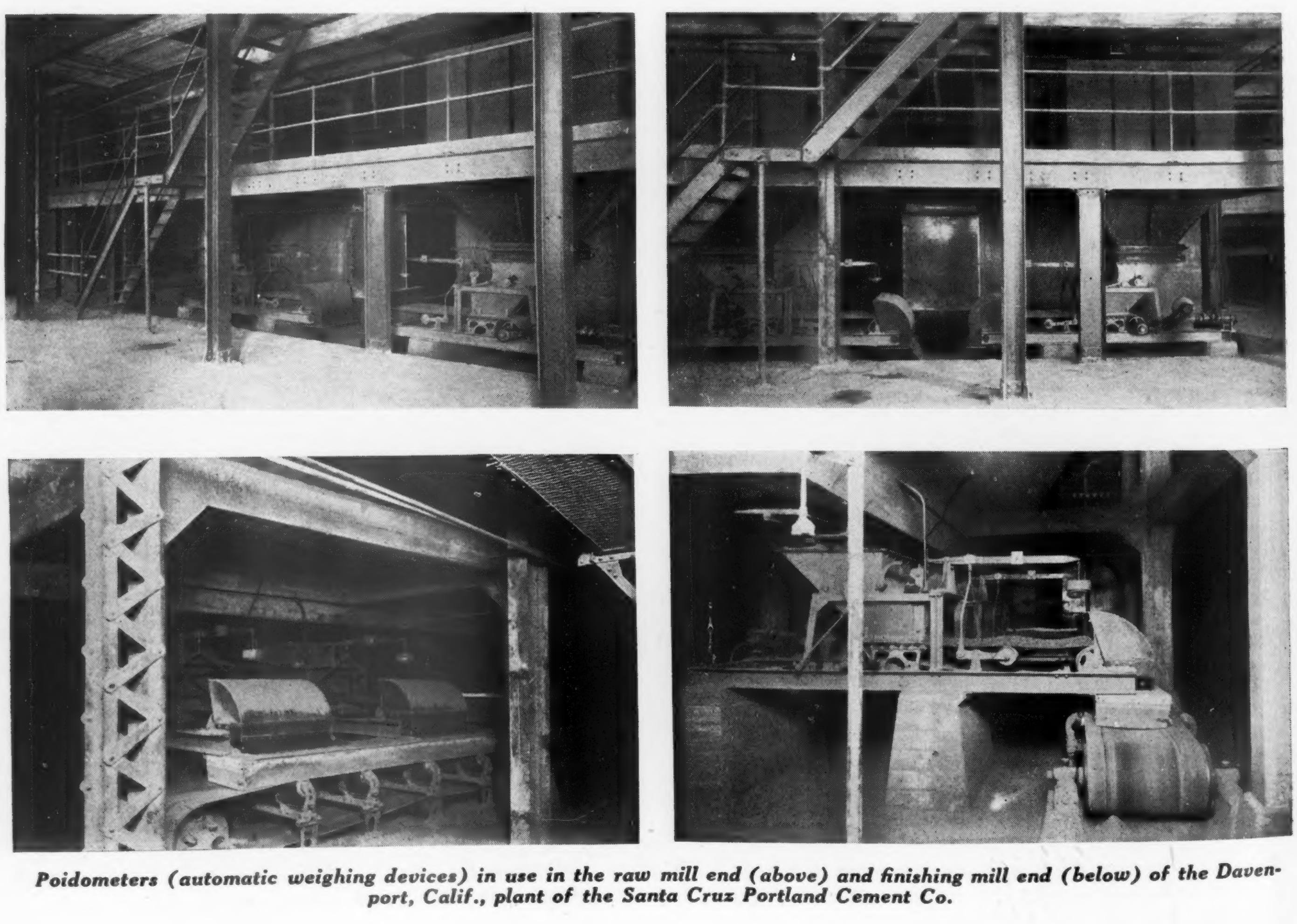
West Penn—Progress on the new wet-process plant of the West Penn Portland Cement Co. at West Winnfield, Penn., was described in our October 2 issue. This is a new organization. One kiln is expected to be in operation early in 1927. The ultimate development calls for three kilns of 2,000 bbl. capacity each—a total of 6,000 bbl. daily or 2,000,000 bbl. per year.

Wyoming—The Del Mar Co. is reported to have acquired property near Laramie, Wyo., for the construction of a cement plant.

Yosemite—After many vicissitudes, construction of the Merced (Calif.) plant of the Yosemite Portland Cement Co. is reported to be progressing. There are to be two wet-process kilns, 10 x 240 ft., with an estimated daily capacity of 2,500 bbl. (1,000,000 bbl. per year.)

Summary of Developments

New plants, plant additions and improvements in 1926 account for an increase in annual productive capacity of approximately 8,000,000 bbl. (Canada not included). According to United States Department of Commerce statistics, the productive capacity of the industry at the end of 1925 was 193,000,000 bbl. Its productive capacity at the end of 1926 we estimate at 201,000,000 bbl. Plants now under construction, which are practically certain to be completed in 1927, will add 12,000,000 bbl. of annual productive capacity, while projects are afoot which, if they materialize, will increase this to 22,000,000 bbl. Therefore Blaine S. Smith's estimate of a productive capacity of 215,000,000 bbl. by the end of 1927 would seem conservative. Moreover, these figures do not take into account projected increases in the productive facilities of existing plants, which will certainly add at least 2,000,000 bbl. to our estimates. In other words, there is every prospect of an increase in productive ca-



Poidometers (automatic weighing devices) in use in the raw mill end (above) and finishing mill end (below) of the Davenport, Calif., plant of the Santa Cruz Portland Cement Co.

pacity in 1927 of between 14,000,000 and 15,-000,000 bbl., and a possibility of 22,000,000 to 24,000,000 bbl.

It is obvious, of course, that the industry is making more than ample provision for any possible increase in the consumption of cement, and only by the best and sanest of management can it maintain its present plane of prosperity.

Technical Progress

The foregoing list of developments and improvements is, of course, by no means complete, but it does give a very excellent cross-section of the kind of development that is taking place in the industry. There seems yet to be no standard of the length of rotary kilns for the wet process, either with waste-heat boilers or without. Two of the new kilns now being installed are 330 ft. long, and one is 343 ft.—longer by nearly 100 ft. than any kilns now in use. On the other hand, one company which now operates 235-ft. kilns is considering reducing their length to 175 ft. and installing waste-heat boilers. The kilns at the Sandt's Eddy plant, which has waste-heat boilers, are 160 ft. long.

Should the use of filters to remove part of the water in slurry, as described at the plant of the Ford Motor Co., become general, it is difficult to see why such long kilns are required in wet-process plants without waste-heat boilers.

There has been some progress made in grinding practice, and undoubtedly nearly all the companies are paying more and more attention to finer grinding at both raw and finish ends.

One notable development in grinding practice is the growing popularity of such automatic weighing devices as the Schaffer poidometer for feeding the grinding mills. These devices have long been used in the cement industry to proportion raw materials, gypsum, etc., but their wide use for measuring the flow of dry materials to mills, both raw and finish, and for proportioning the water to the dry materials in wet grinding are comparatively recent developments. This is also evidence of the increasing control over every manufacturing operation in the cement industry, which is obviously reflected in the growing superiority of present American portland cement over previous standards, and over competitive material from abroad.

One subject which now has a major interest in the cement industry is dust collection, not only to avoid being a nuisance in settled localities, where many of the new plants are being built, but to recover a valuable product. Electric precipitation of hot stack dust, which offers the greatest problem in economical recovery, is again coming to its own, after its war-time potash recovery boom. The experience of the Osborn plant of the Southwestern Portland Cement Co. in reclaiming nearly 1,800 lb. of stock dust per hour per kiln by means of electrical precipitators is proving that the value of the dust recovered as a raw material pays dividends on the installation. With 64 tons of dust collected from the three kilns per day, it is evident the installation must pay, remembering that the dust recovered is the finest product of the grinding mills—the product that costs the most to make, and the product that makes the best cement. For this reason there is a new interest in dust recovery and many new and interesting developments expected within the next year.

Plan New 3000-Bbl. Cement Mill for Knoxville

A RECENT report in the *Manufacturers Record* outlines the plans for the construction of a cement plant to be built at Knoxville, Tenn. A charter for the new company has been applied for, it is said, naming J. Ross Hanahan, Charleston, S. C., as president; H. J. Davis, Knoxville, and Maj. F. H. Lewis, Philadelphia, as engineer for the new company. The proposed mill will have a daily capacity of 3000 bbl.

The same report says that a press despatch from Knoxville states that approximately 350 acres of land east of the city has been purchased as a site for the plant, which will cost $1,500,000, and that the new company to build and operate it will be capitalized at $1,750,000.

Mr. Hanahan was formerly one of the owners of the cement plant at Leeds, Ala., sold to the Atlas Portland Cement Co., and since has been identified with the Carolina Portland Cement Co. Mr. Davis is president-treasurer of the East Tennessee Coal Co., secretary-treasurer of the Knoxville Fireproof Storage Co., and interested in other enterprises in and about Knoxville.

Olympic Portland Adds Third Kiln

DURING the past year the Olympic Portland Cement Co., Bellingham, Wash., completed several improvements at their plant which resulted in increasing the capacity about 50%. Among other things, a third kiln, 9x10x175 ft., was installed and the quarry properties purchased from the International Lime Co. extended. About $300,000 was expended to make the change to a modern 3,000 bbl. per day mill. The company's production this year was about the same as last, 600,-000 bbl., of which 550,000 have been shipped to date. — *Bellingham (Wash.) Reveille.*

New Swiss Cement Standards

THIS year a new standard specification for cement has been adopted in Switzerland, in which three types of cement are recognized, viz., portland cement, high early strength portland cement, and high alumina cement.

The minimum strength of portland cement cubes, after curing under water, is fixed as follows: Tensile strength: 7 days, 283 lb. per sq. in.; 28 days, 397 lb. per sq. in. Compressive strength: 7 days, 3,263 lb. per sq. in.; 28 days, 4,61? lb. per sq. in.

Special cements of high early strength are now termed "Ciments a hautes resistances." They are in two classes, according to their chemical composition, viz.: (1) portland cement of high strength; (2) aluminous cement.

Portland cement of high strength differs from the ordinary in having a special preparation for its raw materials, and in a more intense burning. To allow for special conditions under which cements of high strength are used, briquettes made and cured under the same conditions as ordinary portland cement must have the following minimum strength: At three days, 397 lb. per sq. in. tensile strength; 4,615 lb. per sq. in. crushing strength. At seven days, 496 lb. per sq. in. tensile strength; 7,095 lb. per sq. in. crushing strength. At 28 days, 567 lb. per sq. in. tensile strength; 9,223 lb. per sq. in. crushing strength.—*The Quarry and Surveyors' and Contractors' Journal.*

Recognize Water-Cement Ratio

THE building code committee of the United States Department of Commerce recognizes the "water-cement ratio" as means of mixing concrete of a specified strength in a series of suggestions it makes in its booklet, "Recommended Requirements for Working Stresses in Building Materials." The "water-cement ratio" is the law governing the strength of concrete. It states that the strength of concrete is in inverse proportion to the amount of water used in mixing provided that the mix is workable and that the materials used are clean and sound. Many engineers and builders had believed this was the factor governing the strength of cement and it was proved to be such by Duff A. Abrams, director of the Portland Cement Association Laboratory, who established the law after a long series of tests.

In the government booklet a series of tables are given in which the strength of concrete is shown to be directly dependent upon the quantity of mixing water used. Several aggregate proportions are given, but in each case the resulting strength bears a definite relation to the volume of mixing water.

A suggestion, similar to that issued by the Department of Commerce, has been made in a proposed building code prepared by the Pacific Coast Building Officials Conference.

Edison Portland Starts School for Foreign-Born

A SCHOOL for foreign-born men and women has been established by the Edison Portland Cement Co. at New Village, N. J., where one of the company's plants is located. The object is to teach employees and others who desire to attend, the fundamentals of government, reading, writing and arithmetic, and to prepare them for obtaining nautralization papers. Three teachers are engaged at the company expense.

Sand and Gravel Industry Has Good Year

Production Estimated Over 190,000,000 Tons—Outlook for Most Sections Is That Fully as Good Conditions Will Prevail in 1927

SAND and gravel production is estimated at 192,000,000 for the whole United States in 1926. This is 15% above the 1925 production and glass sand is not included. The actual weighted averages from producers reports show a somewhat higher increase but this is discounted through the knowledge that reports did not come in so freely from localities where production was lower than last year. The price declined in certain parts of the country and in other parts it rose, but as a whole there was a decline of 2½% from the price of 1925.

Good conditions were reported by 69% of the producers, indifferent conditions by 22% and bad conditions by 4%. Five per cent did not report on conditions.

Reasons for increased business were given as follows: Highway and road work, 42%; general construction, including city paving 51% and generally prosperous conditions, 7%.

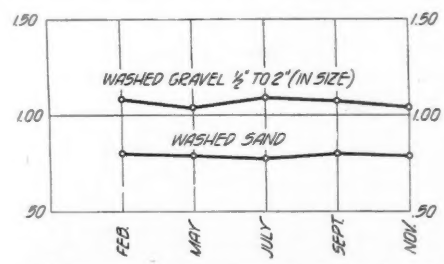
As for the prospects in 1927 there was a disposition to be somewhat less optimistic than in former years. Fifty-nine per cent said prospects were good; 24% said only fair, 10% said they offered better conditions than were present in 1926 and 7% said unqualifiedly that prospects were bad.

This year for the first time producers were asked by Rock Products to classify their output. This classification showed the following:

Railway ballast (washed)	10.5%
Concrete materials	59.0%
Mason and plaster sand	16.0%
Unwashed pit run	14.5%
	100%

Washed ballast production probably shows a considerable increase as 26% of the producers reported making it. Last year it was mentioned by only 2% of the producers.

With only one exception, producers reported good labor conditions and that exception said they were fair. Wayside pit competition was reported serious in only a few localities. There was overwhelming evidence to show that users of sand and gravel demand a better quality of product than they formerly did, and this of course accounts for the decline in wayside pit production.



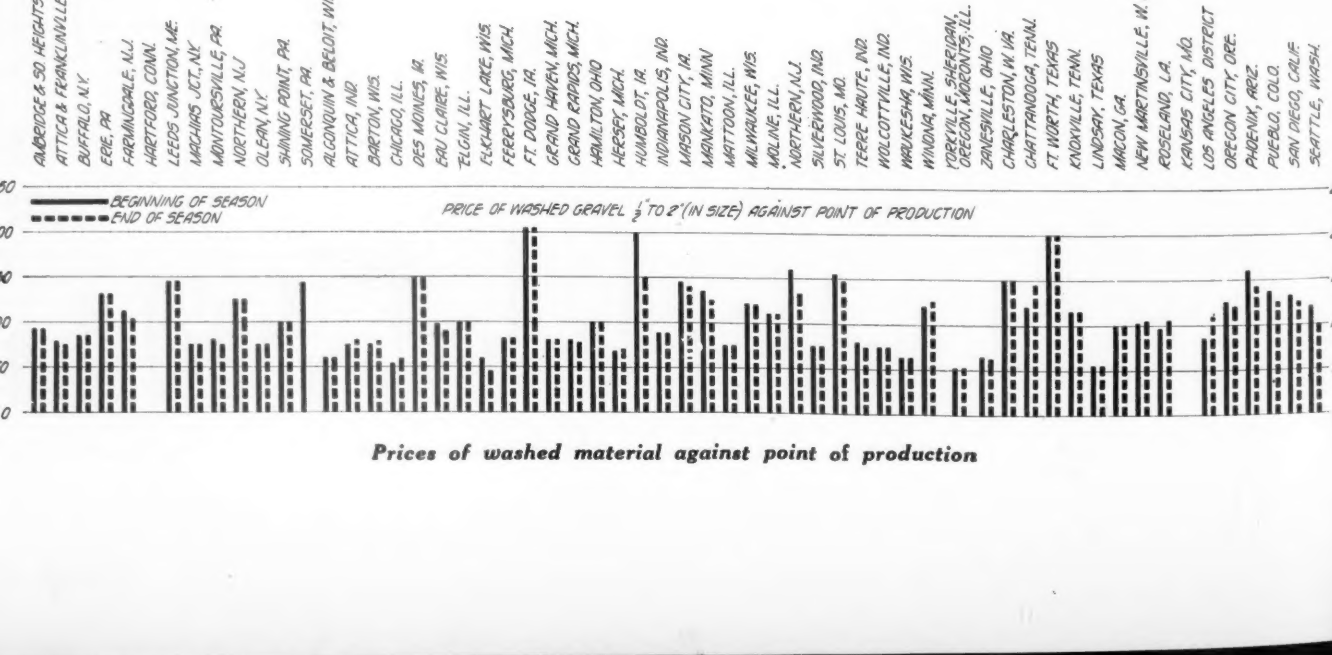
Average prices of washed sand and washed gravel fell slightly

A majority of the producers expect 1927 to be a good year for both general construction and road work, the greater number placing both these as reasons for expecting good business in 1927. Some few specified proposed railroad construction and city paving programs as their reasons for good prospects.

Generally speaking the large manufacturing states showed the heaviest increase in production and the agricultural sections reported decreases both in production and price. This was especially noted of the states just west of the Mississippi river. The fall in the price of cotton apparently came so late in the year that it did not affect the work already in hand, but some sand and gravel producers in cotton growing sections expect it to affect next year's output.

Engineering Research and Technical Progress

The year passed without any strikingly new developments in washing and screening practice. And while some good sized plants were erected, as told in succeeding paragraphs, none of these showed any wide departures from usual forms. However, it was a year of considerable progress for the industry, and one of the most important directions which that progress took was



Prices of washed material against point of production

technical research connected with the industry. This is the first full year for the Division of Engineering Research of the National Sand and Gravel Association to function, and its effects have had a marked effect upon the industry. The mere contact with such specification making bodies as the American Society for Testing Materials makes it worth while, for, as John Prince warned the Missouri Valley Producers, "such specifications come back to us to be filled, and the only time we can object to any feature of them is while they are being adopted." Stanton Walker, the director of the Research Division, is on the committee of the A. S. T. M. which is at present considering national specifications for both sand and gravel.

Mr. Walker told something of his work at the Missouri Valley meeting and what he said will be reported in the January 8 issue. Readers of ROCK PRODUCTS and of the *National Sand and Gravel Bulletin* know of his strictly technical work, especially in emphasizing the value of gravel as concrete aggregate. Among his published papers is one, which was widely reprinted, on the importance of uniform aggregate, and another giving an excellent and very simple method for estimating concrete materials. In several instances discriminations against gravel in concrete aggregate have been removed, and more of this work is expected to be done in the coming year through his efforts.

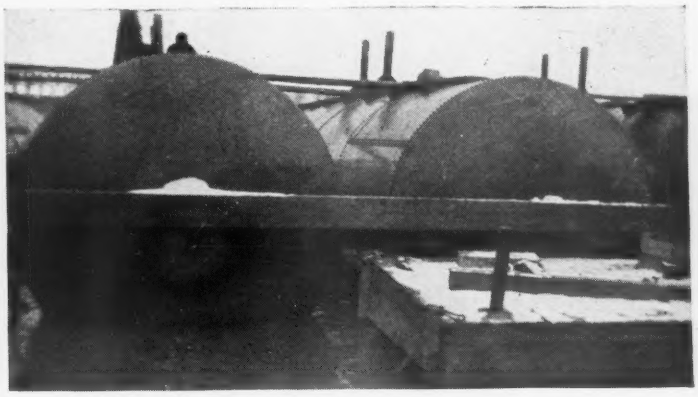
Plant Details—Storage

Running over the new plants built during the year and the plant improvements, one notes first a tendency to increase storage facilities. This is not only to provide material to carry over the peak of the season; it is quite as much to insure steady operation of the plant. The favorite method is still probably that of using a locomotive crane to unload cars to ground storage, but belts in tunnels over which stock piles are built are growing in favor. A very large installation of this kind is noted in the plant of the Buffalo Gravel Corp. now being built at Buffalo, N. Y. A method which is comparatively new but which will be used more in the future is that which employs a scraper bucket and traveling tower. It is described in detail elsewhere in this issue.

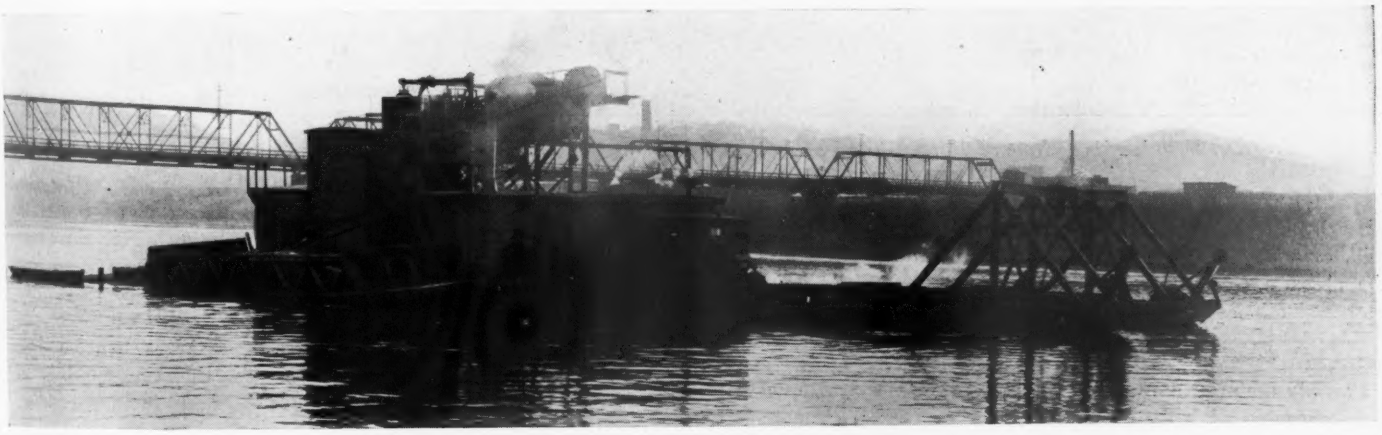
Sand Recovery

Some interesting sand recovery installations have been made. One of these is at the Manor plant of the Charles Warner Co. at Tullytown, Penn. The sand pumped with water by a 16-in. pump is discharged into a large circular tank provided with a partition over which the overflow passes. Ample settling space is provided for both concrete sand on the first side and the fine sand that goes with the overflow on the second side. The tank is sunk to just about the water level of the slip in which the barges lie for loading. Elevators with dewatering buckets raise the sand and deliver it to barges. The motion of the elevators in the water washes the sand thoroughly and prevents the clay from settling with it.

An interesting sand recovery plant was built by the Stewart Sand Co. at Kansas City this year and it was described in the April 17 issue. Its unusual feature is that it contains a series of hindered settling classifiers delivering on a conveyor belt. By discarding one or more of the classifier products any desired grading of sand may be obtained on this conveyor belt.



Building pontoon hulls for barges at Ward Sand and Gravel Co.'s plant, Oxford, Mich.



New dredge of Stewart Sand Co., Kansas City, Mo., which cleans sand pumped from under 6 ft. of mud

This plant worked so well that a similar installation of classifiers was made on a new dredge built by the company. This dredge is extraordinary in that it was deliberately designed to pump through 6 ft. of mud which lies above the sand. In spite of this, it produces a perfectly clean and well graded sand.

The reason why so much effort has been expended and such great progress made in the washing and grading of sand at Kansas City is that producers there have been confronted with a decreasing supply of material that will pass the present-day specifications without special treatment. This condition is one which will occur in many other places within a few years. Recognizing this, the Dorr Co., which has had much experience in classifying and washing mineral substances in the metallurgical and chemical fields, has introduced a new hydraulic "sizer"

which is an automatic discharge machine working with a rising current. It is described in the new machinery section of this issue.

The Stewart Sand Co. also built a filler sand plant, employing both screens and classifiers, which will be described in detail in a later issue.

Crushing Gravel

Crushing gravel to fine sizes is still a problem, if the crushing is to be profitable. The Greenville Gravel Co. installed a high speed cone type crusher for fine crushing in its new plant at Columbus, Ohio, and the Memphis Stone and Gravel Co. a hammer mill, especially designed and built to resist the abrasive effect of gravel, in its plant near Paducah.

Floating Equipment

Possibly the most notable improvement in floating equipment is the use of the pontoon hull. This has been used before, but this year its use has been greatly extended, as it has been applied to both dredges and barges. It has many advantages; the pontoons (which are also called "boilers," "tanks" and "cylinders") can be easily built at the shop, taken on railroad cars to the job and then rolled into the water for connecting up without injury. This saves first cost. Such pontoons are stronger than any other simple form employing the same weight of steel. It is not easy to make them leak, and if a leak does occur it does not affect the whole hull but only the individual pontoon. Repairs are easily made if the hull is so arranged that a pontoon may be disconnected and rolled in the water until the part needing repair is brought uppermost.

But such equipment is not suitable for shallow water, because a much greater draft is needed for the same displacement than for the ordinary flat-bottomed hull. Neither is the pontoon hull so rigid as the flat-bottomed hull built with interior trusses and adequate cross-bracing, as it should be where much motion from machinery is communicated to the hull. So while the advantages of the pontoon hull are recognized and should be used where conditions will permit, it appears that in many cases the flat-bottomed hull should be preferred.

Report by Districts

Following are the reports given by districts. In making up these districts an attempt was made to include in each of those states or parts of states, in which producing and marketing conditions were more or less similar. In general, the sand and gravel industry divides itself for marketing into certain cities or groups of cities and this was also borne in mind in making the grouping. Reports of conditions, increases and decreases in output and in prices are from producers' reports. Reports of new construction were confirmed wherever possible by writing to the company involved or to others acquainted with the facts.

New loading plant of Boston Sand and Gravel Co.

New England

The New England producers as a whole enjoyed an exceptionally good year and the increased production will probably be equal to that of the average of the whole country. In the largest city, Boston, building was very good and other forms of construction were active. The prospects for 1927 in Boston are reported fair, although speculative building is expected to decline. Only one new plant is reported from the Boston district, but it has been reported that the building of a large plant is contemplated, to be finished some time in 1927.

In Maine some heavy increases in production have been reported, the largest being due to the building of a hydro-electric power plant. If the legislature will pass a law permitting the export of power to other states, more of such enterprises will be started. Better road legislation for the state is said to be needed. One Maine producer complained of high freight rates.

In Connecticut good business was reported at Hartford, but it was stated that credits should be watched closely. A Connecticut producer from another part of the state also reported an unsatisfactory credit condition. Public and semi-public works absorbed a great deal of the production. The outlook both for road building and general construction is said to be excellent in this state.

The new plant near Boston is that of the Suburban Sand and Stone Co. and it has a present production of 500 tons per day. It began business last April on a deposit which contains 68% of gravel, much of which requires crushing. Both a steam shovel and a dragline have been employed in excavating. Water for washing comes from the pit. The plant contains a 14x28-in. jaw crusher and screening equipment. The property contains a ledge of stone that may be developed later.

The Boston Sand and Gravel Co. has put in a truck loading system at its plant near Scituate, Mass. The sand comes down a flume and is sent to the bins by two Link-Belt sand screws. Gravel comes in from the plant over a 24-in. belt 75 ft. long. There are four bins from which trucks may load and a 24-in. belt 193 ft. long takes either sand or gravel from any one of the bins and carries it to a hopper above the railroad track for loading cars.

New York State

New York State (not including the district around New York City) reported excellent business and good prospects for the coming year. In some parts of the state business was said to be no better than last year, although no actual decreases were reported. The outlook varies with the locality, some producers reporting it good and others only fair. It seems to be the opinion that the plants in operation and those which have been just built, or are being built, are amply able to care for all the increased production that may come in 1927, so that no more plants should be built at present.

Several new plants were built during the year. The first to be completed was that of the Albany Gravel Co., at Albany, which was finished in April and described in the April 17 issue. It has an innovation in the shape of an octagonal hopper for receiving the bank material dug by the scraper bucket used from any side. The plant contains the usual crushers, screening equipment and uses Good Roads Machinery Co. sand boxes in series for classifying as well as washing sand.

The Madison Sand and Gravel Co. completed its plant at Solsville early in June and this was fully described in the September 4 issue. The flow-sheet is designed to produce as much crushed stone as possible and all the product, both sand and crushed stone, is thoroughly washed. Monighan dragline excavators dig the bank material, which is sent to the plant on a conveyor

belt by means of an unusually well designed feeding hopper. The plant was designed and built by the Smith Engineering Works.

Carroll Bros., Buffalo, began production with a plant at Clarence about August 1. The deposit is said to contain 300 acres and the sand and gravel is 60 to 70 ft. in depth. The plant was designed and built by the Brown Hoisting and Machinery Co. and details are to be published later.

A plant was started at Sherburne by J. F. Paddleford, a road contractor, who will not only use his product but conduct a commercial sand and gravel business. Latest reports from this plant are that the foundations for the machinery are placed and the sidetrack is laid. It is expected to begin production some time in the spring and the output is expected to be 800 tons a day.

The largest and most important plant to be built in the state this coming year is that of the Buffalo Gravel Corp. at Buffalo. This is to be a washing and screening plant of perhaps 4000 tons daily output, the material being dredged from Lake Erie and brought to the plant dock by barges. The unusual feature of this plant is its very large storage capacity for both crude and finished material. Storage piles will be built over tunnels in which conveyor belts run. All the designing and engineering work is being done by the Link-Belt Co.; C. S. Huntington, engineer. Foundation and tunnel construction is practically complete.

Several small plants for purely local construction have begun business during the year in addition to the plants mentioned.

New York—Metropolitan District

This, the most densely populated area of the United States, includes what is called the metropolitan area around New York City and northern New Jersey. Almost 10% of the population of the United States lives in this area, and as building was very heavy during 1926 the production was large. One of the companies which is among the few very largest producers in the United States reported a 35% increase and said that especial effort had to be made to keep up with the demand. Other producers also reported large increases.

Prospects for the coming year are considered good from the amount of public and semi-public work that is contemplated, already arranged for, or now going on. Residential construction, however, accounts for the greatest percentage of new construction, and there was some slackening in this line during the latter part of the year.

The smaller plants, of which there are a considerable number in the district, that make truck deliveries to nearby points, have reported a fairly good year, with moderate increases of plant output. Some of these have reported that prospects are fairly good in both the general building line and in highway construction.

No very large plants were reported as having been built in the metropolitan area, although considerable work in enlarging and improving existing plants was done.

In northern New Jersey a decline in price was reported, one producer reporting a drop of 8%. One producer in this section said there was a need of better freight rates in order to meet water competition.

Philadelphia, Baltimore and Washington District

This district, which includes south New Jersey, eastern Pennsylvania, Maryland and Delaware, was not so thoroughly reported as some others. From the information at hand it appears that the industry held its own in the localities named, with some increase in the production of plants supplying the larger cities and a decrease in those supplying the smaller towns and country districts. The largest plants in this district are near Tullytown, Penn., and business here has been reported good. From Washington business was also reported good, but it was added that there was a possibility of a decline in 1927, as the big government building program will not be under way for a year or so. Baltimore producers reported good business and an excellent outlook due to the large building program planned for 1927. In eastern Pennsylvania one producer reported that business was slow, as certain projects were holding off, expecting a lower cost for labor. Road work, of course, is not the factor in this district that it is in some others, so this refers to general construction. In south New Jersey production was reported to be about the same as it was in 1925. Some competition from wayside pits and improperly prepared material is reported from this locality.

One new plant, that of the Glacial Sand and Gravel Co. at Phillipsburg, is reported from this locality. Prices were about the same or a little lower.

The sale of the D. N. Thomas Sand and Gravel Co., Williamsport, Penn., to the West Branch Sand and Gravel Co., Northumberland, was reported. The Van Sciver Corp., Philadelphia, built a storage and distributing plant, and the Garden Sand and Gravel Co. at Norristown added storage facilities. Various other plants made some improvements, including those made to the Manor plant of the Charles Warner Co., mentioned elsewhere.

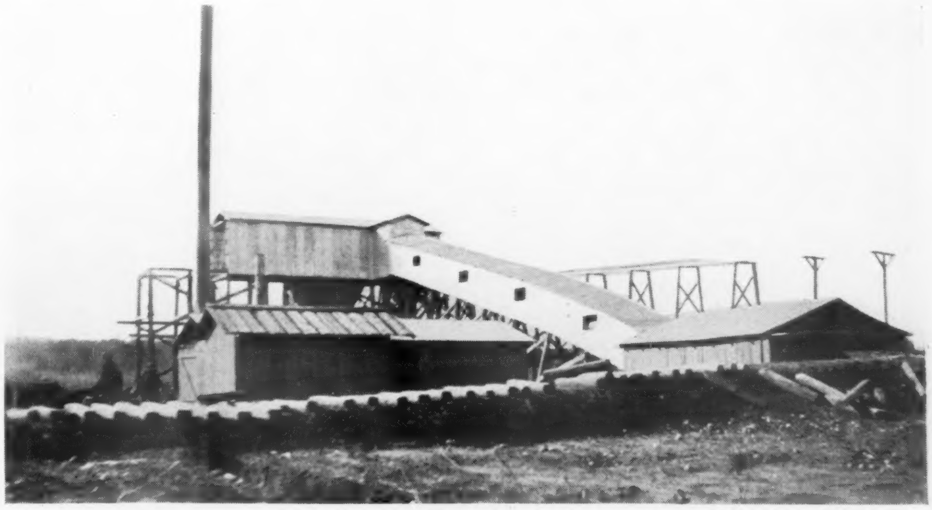
Pittsburgh District

The area including Pittsburgh and the industrial towns around it and along the upper Ohio east of Cincinnati is reported to have had a good year. The Pittsburgh producers found it unusually good, one large producer reporting a 30% increase in output over 1925, which was considered an excellent year. Away from the city business was not so good, some plants reporting considerable decreases. This was true generally along the upper Ohio, with one or two exceptions. The slump in the pottery industry and the decline in industrial plant building is given as a reason for this. However, one producer, who reported an 8% decrease, said that prospects for 1927 were very good, and this seems to be the general opinion. Price held fairly steady, with some decreases.

There was a good deal of new construction and plant improvement in this district. The Rodgers Sand Co., one of the large Pittsburgh operators, put its new dredge, the "Captain," in service. It was built at Pittsburgh by the Dravo company. The General Sand and Supply Co. of Pittsburgh is reported to have built a new plant at Wellsville, Ohio. It is reported that a new plant will be built near East Liverpool, Ohio.

Ohio

The entire state of Ohio, with the exception of the portion already mentioned, had a very good year. Producers uniformly reported increases, and this means more than in some sections, as some of the largest producing companies in the country are in Ohio. Increases of production as high as 30% are reported by larger companies, and one of the smaller companies reported a 100% increase. Prices appear to have held about the same as in 1925 throughout the



Plant of Wolf Creek Sand and Gravel Co., St. Louis, Mo., at Delight, Ark.

state. The companies supplying the larger cities, Cleveland, Cincinnati, Toledo, Columbus and Dayton, all have enjoyed good years and have good prospects for business in 1927.

A great deal of new construction and plant improvement is reported from Ohio in 1926. Probably the largest plant built was that of the Greenville Gravel Co. at Columbus, described in ROCK PRODUCTS of November 15. The Arrow Sand and Gravel Co. is building a new plant, an outline being given in an editorial letter in the October 2 issue. It was reported that a new corporation, the Mound Street Gravel Co., would also build in Columbus.

In Cincinnati the Hall company built a new 15-in. pump dredge to work on the Ohio river. The Red Bank Sand and Gravel Co. put up a plant near Cincinnati for making truck deliveries to the city. This has unusual washing and screening equipment, some of which is made under patents held by the company.

At Mantua, which is half way between Cleveland and Youngstown, the Mantua Sand and Gravel Co. built a 12-in. suction dredge equipped with a 45-ft. cutter shaft and erected loading bins and washing and screening plant. The greater part of the output will be concrete sand and the principal market is in Cleveland.

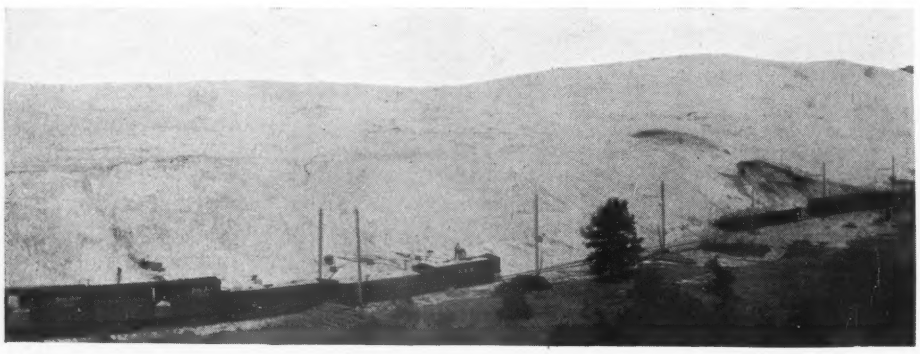
The Middletown Sand and Gravel Co. built a plant for truck delivery at Middletown. This produces two grades of washed sand and washed gravel of any size from 2 in. down. This plant has been in operation since the first week in June. At Marion, the Marion Sand and Gravel Co. is building a new plant on the property it has worked for some years.

Illinois and Indiana

The two states of Illinois and Indiana produce something like 12% of the entire production of the United States, and this year the percentage may be even higher. Throughout the Chicago district producers uniformly reported large increases in output. One of the larger Chicago producers reported a 65% increase, and others 25%, 17% and like increases. This is easy to understand from the building reports, which show a large increase in building for this district. The price, however, was distinctly lower, so low in fact that one Chicago producer described the situation as "plenty of business with all the profit squeezed out of it."

A large part of this business was done late in the season. One large producer who ships into Chicago is said to have been very far behind the 1925 record on September 1 and to have made up this shortage and an added 350 cars by November 1. This condition was due to the weather, which delayed construction early in the year.

Around Indianapolis, producers reported outputs about the same as or a little better than last year. The Wabash valley producers and others outside of the Indianapolis district appear to have had a very good season. One producer, whose output cannot be considered small, reported an 80% increase, two others reported 40% increases, and one a 50% increase. However, some decreased prices were also reported.



Loading dune sand at Michigan City, Ind., by the S. J. Taylor Sand Co.

Decreases in production were reported from those parts of Illinois in which disastrous floods occurred during the summer and in the coal mining regions.

Both highway building and general construction absorbed this large output, with general construction leading by a considerable amount. One or two plants reporting a heavy increase said that it was due to large orders for railway ballast.

Wayside pit competition was reported to be serious in localities away from the larger cities, but in general the tendency was to demand a better quality of product.

Prospects on the whole are considered to be very good for 1927. Illinois is planning a very large road program which will use material from both states. General construction, including town and city paving and railroad work, promises to hold up to something like its present level. The demand for better highways is reported to be strong from rural districts in spite of the lowered price of agricultural products.

About the usual amount of new construction and improvements is reported, without any addition of large or important plants. The Risley Sand and Gravel Co. rebuilt its plant at Dixon, Ill., early in the season. The McGrath Sand and Gravel Co., Lincoln, Ill., which operates a number of plants in Illinois and Indiana, improved its Chillicothe, Ill., plant and added a 15-in. pump to the two Sauerman cableway excavators, enabling the plant to increase production at least 50%. A large storage system, built over a belt conveyor in a tunnel, was also installed. At Galesburg, Ill., a new plant was reported to be building by A. R. Anderson & Co. Coogan and Clark of Peoria, Ill., were reported to have leased the old Rock Island pit near Chillicothe and to be erecting a plant, and new equipment and storage is reported to have been erected at Sheffield, Ill., by Macklin and Wolf.

At Sylvia, Ill., the Milan Sand and Gravel Co. built a plant on the Rock Island which does both a railroad and trucking business. Equipment includes a Sauerman cableway, a revolving screen and sand settling tanks.

A special feature of the industry in Indiana is the loading of dune sand along the shore of Lake Michigan. This is sold without further preparation, and as it is high in silica (about 95% SiO_2), the sand finds a big market for foundry cores, steel casting and some sorts of glass making. The S. J. Taylor Sand Co., which ships this sand from near Michigan City, made additions and improvements and will replace its steam locomotive crane with an electric crane.

At Indianapolis the Granite Sand and Gravel Co. made important plant improvements. The Keystone Gravel Co. put up an all-steel plant with two Sauerman 1-yd. outfits, an American hoist, a Mundy hoist, and a Telsmith screen and crusher. This plant has a new type of receiving bin to enable the dragline bucket to dump into it from various points.

The Burr Oak pits near Culver, Ind., were opened early in the summer by E. A. Keappler and a plant begun. This is a dredging operation to employ a 12-in. pump dredge. Storage is over a concrete tunnel with belt. At Winchester, Ind., the Winchester Gravel Co. made improvements, and the New Harmony Gravel Co. put a new dredge in service in the Wabash river. Abe Hart, Sandborn, Ind., sold one of his dredging plants to a Missouri concern and is building a larger plant to replace it.

Michigan

Reports from Michigan are varied. The district which supplies Detroit, near Oxford and Brighton, showed increased production as a whole, although some plants reported the same production as last year. The same is true of plants near Flint. In other parts of the state some plants reported a decreased production.

Important changes in organizations took place in the district supplying Detroit. The old United Fuel and Supply Co. was sold to the C. N. Ray Corp. of Detroit, as told in the June 12 issue of ROCK PRODUCTS. A new company called the United Fuel and Supply Co. was formed, which took over certain of the assets of the old company of the same name, including the Birmingham Sand and Gravel Co. and certain of the boats belonging to the Detroit Steamship Corp., also certain assets of the

Superior Sand and Gravel Co., the Delta Brick and Tile Co. and a controlling interest in the Huron Sand and Gravel Co. The business as now constituted is one of the largest in the United States and is said to be the largest in Michigan.

The Ward Sand and Gravel Co., the largest producer in the Oxford district, again broke all records for a year's output, shipments at times reaching 300 cars per day. Improvements are reported to be in progress by which the output will be further increased during the coming year.

The Ray Sand and Gravel Corp. (formerly the United Fuel and Supply Co.) is rearranging its flowsheet to eliminate transportation over long distances so far as is possible. The crushers will be moved to the field conveyors with this end in view.

The P. Koenig Coal Co. has installed Stephens-Adamson sand classifiers and two new belt conveyors and will eliminate the booster pump and pipe line tramway from the plant. The new system dewaters the dredge discharge at the water's edge and then elevates the solids to the screening plant. Other improvements are contemplated.

The Fuller and Becker Co. is adding another Swintek cutter to the dredging equipment and will make some other changes in the plant.

The Port Crescent Sand and Fuel Co., Port Crescent, Mich., has added a 350-ft. traveling field conveyor to its conveying system, which was described in the June 27 issue. It will be remembered that this employed nearly a mile of conveyor belts. The new conveyor will operate over both sides of the 1500-ft. conveyor system which loads boats directly from the bank. A large screening unit with six Bonnot piano wire screens, fed by six Stephens-Adamson feeders, has been installed. The company produces dune sand, all of which is shipped by water.

In Grand Rapids the Kent Sand and Gravel Co. has been organized by Gilbert A. Houke, and at last reports a plant was being built by this company. Mr. Houke also acquired the East Grand Rapids Sand and Gravel Co.

It is reported that Bichler Bros. of Escanaba, Mich., are erecting a plant near Escanaba. Their plant at Grove, Mich., was destroyed by a fire early in the spring.

The Lenawee Sand and Gravel Co. practically rebuilt its plant near Tecumseh, Mich., the capacity of the new plant being double that of the old. The Leonard Gravel Co. opened a new pit at Lansing and is said to have four now in operation.

Wisconsin, Minnesota, Iowa and the Dakotas

The sand and gravel business has been good in Wisconsin all over the state; in some parts of Minnesota it has been good, in others poor; in Iowa, producers largely reported decreases and lower prices, and in the Dakotas some plants reported increases and others decreases.

Wisconsin's production is pretty accurately known from the records of the Wisconsin Mineral Aggregate Association, and it is estimated to be 12½% greater than that of 1925. The reason for this was the great increase in general construction, which absorbed 65% of the state's output. Next year's prospects are good, for while general construction is expected to slacken, highway work will be doubled. The shortage of cars which came about October 1 was something of a setback to production, but appeal to the railroads soon brought relief.

In Minnesota conditions were not good around St. Paul and Minneapolis, due to a decline in all sorts of building. Elsewhere in the state they appear to have been better, several producers reporting substantial increases in output. Wayside pit competition was reported to be serious. One instance was given in which 20 of 25 miles of concrete road was built from wayside pit material. Prices declined, one producer reporting a drop of 25%. "Price cutting for no reason" was given as the explanation of this. Prospects for the state are said to be for better business in 1927 on account of more highway work and railroad construction having been planned.

In Iowa conditions appear to have varied widely in different parts of the state, the gloomiest reports coming from the neighborhood of the capital. One producer who markets much of his product in Des Moines said: "We have cut-throat competition. Conditions are bad and the outlook is worse. Very little building in Des Moines, but we expect an increase in office buildings and semi-public buildings."

On the other hand, producers from other parts of the state made cheerful predictions; one of them reported a 50% increase in output and a better price and said that prospects were for even better business. In the southern part of the state there were delays in both road work and general construction due to rain, but a producer who reported this said that his output was increased 5% over 1925 and his price was 10% better. Other producers spoke of the agricultural depression and said the demand for sand and gravel was poor and prices tended to go down on this account. Taken as a whole, the production of the state will probably equal the 1925 production.

Atwater Street loading plant of the United Fuel and Supply Co., Detroit, Mich.

There was considerable new construction in these states. In Wisconsin the Elkhart Sand and Gravel Co. began the erection of a 25-car plant at Elkhart Lake. The Balkstead Machinery Co. are the construction engineers. Belt conveyors will be used to bring in the material from the bank. In Burlington, Wis., a plant was erected by John W. Peters to have a capacity of 20 cars per day. The newly organized Tiffany Sand and Gravel Co. at Tiffany, Wis., completed the erection of a plant which will begin operations in the spring. Otto Ludwig & Sons have just completed a plant at Thienville which also will go into production in the coming season. The Waupaca Sand and Gravel Co. was purchased by the stockholders of the Moraine Sand and Gravel Co., but it will be operated as a separate concern.

In Minnesota a new plant was built at Fort Ripley by Ostrand & Hallet of Crosby. This is a Telsmith plant and a Green scraper

bucket is used to dig the material. Whitney Bros., who are large producers at Duluth, built a dock 500 ft. long, extending into St. Louis bay, which will have storage for 50,000 tons of sand and gravel.

In Iowa the Automatic Gravel Co. rebuilt its burned plant at Muscatine. The Hawarden Gravel Co. of Harwarden built new bins and added other improvements which will bring its output to 30 cars per day. The old Eddyville Sand and Gravel Co. plants at Oskaloosa were sold and may be dismantled.

Mississippi River—St. Louis, Memphis and New Orleans

Along the Mississippi river from St. Louis to New Orleans conditions as a whole were good. There was some decrease in production from 1925 records in St. Louis and increases in Memphis and New Orleans territory. The low price of cotton in the lower part of this district did not have time to affect this section very seriously, but it has led to rather gloomy predictions for the coming year.

In St. Louis there was a tendency to reduce apartment house and residential building and increase industrial and other large construction. Several contracts will be carried over to 1927. Prices declined slightly in St. Louis. At La Grange, on the Mississippi in the northern part of Missouri, about 5000 carloads were shipped, about half by the Missouri Gravel Co. and half from the state pits.

At Memphis the prices dropped, according to one producer who reported 20% increased production. Other producers reported increases, with no change in price.

In New Orleans the Phoenix Sand and Gravel Co. was formed, a wholesaling company which contracted for the entire output of the principal producers. This was violently attacked as a combination in restraint of trade, but opposition to it subsided later.

There was fully the usual amount of new construction in this district. In Missouri the Lutesville Sand and Gravel Co., Cape Girardeau, began a new plant at Jonesburg early in the year, increasing its capital stock from $40,000 to $100,000. The Missouri Gravel Co. built a large plant at Louisiana, Mo., and the Consumers Co. of Moline, Ill., took over the Pike County Sand and Gravel Co. In Kentucky the James Sand and Gravel company, Paducah, moved its plant to Johnsonville, Tenn., but the plant of the Memphis Stone and Gravel Co. near Paducah was completed and put in operation producing road gravel. This plant has a 120-hp. Diesel engine for power and uses a specially built Williams hammermill crusher for crushing gravel. This same company (W. L. Smith, president) is building a new plant in southern Alabama. At Memphis the Wolf River Sand Co. made improvements described in ROCK PRODUCTS, April 3.

In Louisiana the Superior Sand and Gravel Co. began work on a new plant at Wadsworth in January. The Union Gravel Co., a new enterprise, began work at Monroe, and the Morgan-Parker Co. installed new machinery in its plant at Sibley. At Foresthill Gifford & Hill installed a 10-in. dredge for producing ballast and road gravel. W. H. K. Bennett designed it.

Dredge of the Ross Island Sand and Gravel Co., Portland, Ore., built in 1926

West of the Mississippi and South

This district includes Nebraska, Kansas, Oklahoma, the western part of Missouri and Arkansas, in which localities conditions are about the same in all parts. It includes the cities, Omaha, Kansas City, Little Rock, Wichita, Topeka and Tulsa. Practically all of the production is sand, although there are some important gravel plants at Muskogee, Okla., and a few scattered gravel operations in other places, as at Douglas, Kan. By far the greater part of the production comes from dredging in the rivers.

The reports of the Missouri Valley Sand and Gravel Producers Associatoin, the annual meeting of which was recently held, show conditions to be only fair. The important event in this district was the formation of the Consumers Sand Co., which took over the operations of ten companies and combined them under one management.

Plant of the Ross Island Sand and Gravel Co.

In spite of the fact that the demand for sand was rather light and the plants of the district were amply able to care for all of it, a number of new operations were started. In Nebraska the Lyman-Richey Sand Co., Omaha, built a new steel hull dredge to add to its large fleet of dredges, and the Bailey Sand Co., Fremont, added a new sand pump and motor.

In Kansas City the Stewart Sand Co. built a new dredge with special classifying plant and also designed to dig the deep sand in the Kaw river, which is described in detail elsewhere. Two other small dredges were put in service on the Kaw. At Lawrence, Kan., the Lawson Sand Co. began working, and another company began at Kasota, Kan. The Blue River Sand and Gravel Co. built a plant and dredge at Marysville, Kan. The dredge has a 135-hp. Anderson oil engine and an 8-in. Swaby pump.

There was a great deal of new construction in Arkansas. In Little Rock the Little Rock Sand and Material Co. built a new plant. The Southern Sand and Material Co., the largest producer, combined with the Big Rock Stone Co. At Fort Smith the Arcola Sand and Gravel Co. built a 1500-ton plant. This company is a subsidiary of the Yahola Sand and Gravel Co., Muskogee, Okla. The Central Sand and Gravel Co. put its newly constructed plant in operation at Rodway, and the Drew Gravel Co. installed a newer and larger plant on its ground at Delight. The Wolf Creek Sand and Gravel Co., St. Louis, built a new plant on its property at Delight. A large road gravel operation was started by the Ball-Newark Gravel Co. at Newark. This is a subsidiary of the Ball-Benton Gravel Co., which operates the largest plant in Arkansas at Benton. The Twin River Gravel Co. installed new machinery in its plant near Black Rock.

In Oklahoma the Yohola company, the largest producer, built new retail and storage yards at Muskogee. The Santa Fe Sand Co.'s plant at Perkins will soon produce.

Texas

In spite of a somewhat confused situation in the building of highways, all the producers who reported from Texas seem to have had a good year, as all reported substantial increases in production. One producer said that it was hard to hold up prices, but others reported the price the same as in 1925.

One very large plant was built in the state, that of the Fort Worth Sand and Gravel Co., and this was one of the notable plants of 1926. It was fully described in the August 7 issue. The Smith Engineering Works of Milwaukee designed this plant and furnished the machinery. The West Point Gravel Co., operating near Smithville, installed a Diesel engine and electric drives.

A new concern, the Hilltop Gravel Co., was incorporated at Houston and began operations at La Grange. It was reported that H. W. Thaten is building a plant near Childress.

Gulf Coast States

Conditions in the states of Mississippi, Alabama and Florida were pretty well covered for the early part of the year in a series of editorial letters. Later reports show that production in this area has continued strong for the greater part of the season. No decline in prices was reported and one producer reported a 10% increase. The outlook, however, is not considered so good as it was for 1926, although two producers said that the prospects for road building and street paving were fairly good. The largest producing area in these states is near Montgomery, Ala., and conditions there were reported excellent, one large producer reporting a 20% increase.

Such a strong demand naturally led to a good deal of new construction and improving. In Mississippi, at Hattiesburg, perhaps the largest producing center, the American Sand and Gravel Co., began operations. The plant with others was described in the August 21 issue.

The New Inland Sand Co., of Hattiesburg, has been building a dredge to replace one which was burned early in the year. Practically all the equipment in this district was installed in either 1925 or 1926.

In Alabama, the Gulf Barge and Towing Co. (R. H. Radcliff, president) made a great many improvements, especially to its retail and storage yards. This is the largest producing company at Mobile and exports much of its product to Florida. At Montgomery the Alabama Sand and Gravel Co. added two new plants which will treble its production. One is a dredging and one a dragline operation. The Montgomery Gravel Co. built a new plant at Pruitts to have a capacity of 40 cars a day. It already operates a 60-car plant at Arrowhead. The Tennessee Sand and Gravel Co. began dredging near Sheffield, in northern Alabama, late in the season.

Florida is rather an importer than a producer of sand and gravel (especially gravel), but it has some plants in the northern part. The Acme Sand Co., at Eustis, built a new dredge which will double the output. At Chattahoochie, the Chattahoochie Sand and Gravel Co. went into production. It is reported that Knuth & Miller developed gravel pits near Boynton. The Duo Sand and Gravel Co., West Palm Beach, installed a steam shovel.

Southeastern States

This group includes Virginia, West Virginia, North and South Carolina and Georgia, with parts of Kentucky and Tennessee away from the Mississippi river. Conditions are judged to have been about normal in this part of the country, with little change from the productions and prices of 1925.

Two producers reported that lower freight rates were needed and one producer in North Carolina said that the discrimation against gravel, favoring crushed stone, should be removed.

There was a considerable amount of new construction and plant improvement in this district. In Virginia the Norfolk Sand and Gravel Corp., perhaps the largest producer in the part of the country, referred to here, opened a new pit near Richmond, barging the product to the city. This company also built a 500-ft. dock with material handling and storage facilities at Hopewell on the James river.

In West Virginia, at Morgantown, the Deckers Creek Sand Co. bought the plant of the Deckers Creek Sand and Stone Co. and made improvements. The West Virginia Sand and Gravel Co. is reported to have put a new dredge in service near Eight-Mile Island in the Ohio.

In Georgia the Central of Georgia Sand Co. is preparing to build a new plant at Howard. In Tennessee the Oliver King Sand and Lime Co. put in a new screening plant, and at Johnson City the Freestone Sand and Gravel Co. put in a plant with an 8-in. pump, producing sand only. The plant output will be 600 yd. per day in the spring.

Rocky Mountain States

In this group of states, including Montana, Idaho, Wyoming, Colorado, Utah and Nevada, there is a small sand and gravel production, except for the production of unwashed material for road building and railway ballast. Around Denver, the largest city, business was fairly good. Wayside pit competition was reported serious. Near Salt Lake City conditions were good, with better prospects for 1927.

The Orman Crushed Rock Co. is reported to have built a new plant near Pueblo, Colo., with a 500-yd. daily ouptut. An important combination has recently been reported from Salt Lake under the name of the Stauffer Sand and Gravel Co., which includes the Salt Lake Sand and Gravel Co.

Pacific Coast States

The Pacific Coast states, with which Arizona and New Mexico are included in this review, had a fairly good year as a whole, with some increase, perhaps 5%, over 1925. In Washington, at Spokane, and its surroundings, business was very dull, partly on account of weather conditions. At Seattle and other points on the coast, conditions were good, with perhaps a 15% increase over 1925 production. Portland, Ore., producers appear to have sold considerable material. A curious situation developed from the building of the Ross Island Sand and Gravel Co.'s new plant. It was at first claimed that this company would not have to pay the 10c per ton royalty paid by other producers taking gravel from the Willamette, but the latest report is that the Ross company will pay the same as the others. In California conditions appear to have been about normal, with increased productions in some parts and decreased production in others.

There was considerable new production and plant improvement all along the coast. In Washington probably the largest new plant is the washed gravel ballast plant of the Great Northern Railway. In the Seattle-Tacoma district the Superior Sand and Gravel Co. bought the San Juan Gravel Co. and added equipment. A number of smaller plants reported the addition of new machinery and equipment. In Portland, Ore., the Ross Island Sand and Gravel Co. built one of the largest new plants on the coast. It is a dredging operation and it will be described in full in a coming issue. The Springfield Sand and Gravel Co. at Springfield built a new plant during the summer. Several other plants erected bunkers and added new equipment.

Many New California Plants

There was a great deal of new work done in California. The Rhodes-Jamieson Co., which began work at Eliot late last year, started improving and enlarging its plant in January. The Coast Rock and Gravel plant at Eliot was also enlarged and improved. On the Sacramento, the River Sand and Gravel Co. built a plant at Bernica. The Niles Sand and Gravel Co. began building its 2000-ton plant at Coyote in July, and the Pratt Rock and Gravel Co. bought the American River Sand and Gravel Co.'s plant at Mayhew and added improvements. All these companies are large producers and operate several plants each.

The Bakersfield Rock and Gravel Co. completed its large new plant near Bakersfield, and this was described in full in the July 24 issue.

A new distributing bunker plant was built by Graham Bros. at San Pedro, and in the Imperial Valley the Orange County Rock Co. built a 1000-ton plant at Frink Siding. Heller Bros. began operations with a large plant, near Calexico, in October.

A number of other plants reported the building of bunkers and adding of minor equipment.

In the Los Angeles district, the Union Rock Co. added the Fewell & Webb Rock and Gravel Co.'s two plants to its holdings and improved its Kinkaid plant greatly. It also bought the plant of the Boulevard Sand and Gravel Co. on San Fernando Boulevard. Large storage bunkers with material handling equipment were erected by this company at Wilmington. The Consumers Rock and Gravel Co. purchased the Harris & Hull plants.

Canada

Very meager reports were received from Canadian producers, but from what was received it is judged that business was no more than normal.

The most important new Canadian plant reported was that of the Ontario Supply and Transport Co. at Sarnia, Ont., on Lake Huron. Gravel is dredged from the lake and washed and screened in a plant which has a capacity of 400 tons per hour.

The Oka Sand and Gravel Co., Ltd., of Montreal, purchased rights for dredging in the Lake of the Two Mountains and was reported in the early summer to be about to build a large floating plant. Two new all-steel carriers were built by this company to transport sand from the company's pits at Oka to the dock in the Lachine canal.

Conclusion

The foregoing is not intended to be a complete summary of developments in the sand and gravel industry, but merely typical of the progress and growth of an industry which was born scarcely more than a score of years ago, and now has an annual output valued at approximately $150,000,000.

Sand Company Tells Engineers How Sand Is Prepared

THE Stewart Sand Co. of Kansas City, Mo., gave a luncheon to about thirty engineers of the city and surrounding towns and cities at the Kansas City University Club, Saturday, December 11. Afterward the company listened to a talk by John Prince, the president of the company, on the methods it had found necessary to use in order to make sand which would pass present-day specifications. Later Mr. Prince asked for a discussion of specifications for sand for water and sewage filtration. He had shown that the methods employed could make almost any grading of sand desired and he wanted to find from them what grading would best serve their purpose, especially for sewage filtration. At present the specifications for sewage filtration sands are "wide open."

Mr. Prince began by showing that Kansas City producers were confronted with a constantly diminishing supply of sand that would pass present-day specifications, without special treatment, and a constant increase in the rigidity with which specifications were drawn. Hence it had been necessary for producers to change their methods and to devise and invent new machines so that they could control the grading and the cleanliness of the product. He showed a lantern slide of one of the old "tipples" which merely collected whatever was pumped from the river in the way of sand and then a picture of the latest classifying plant (described in ROCK PRODUCTS, May 29, 1926) in which the grading of the sand was wholly under control. Then he showed a picture of the new filter sand plant of the company, which is in connection with the classifying plant, and showed how the mean effective size and coefficient of uniformity could be changed to suit almost any specification that could be drawn.

The latest dredge of the company was shown and described and the engineers were told that it was pumping sand from under 6 ft. of mud, something that would have been thought impossible a few years ago. The product of this dredge was clean sand graded to meet any specification desired and perfectly acceptable for state highway and other important uses.

A number of slides of microphotographs were shown and with them the screen analyses of the sands, so that the hearers could see the connection. These screen analyses were plotted as curves and Mr. Prince explained how easy it was to find the characteristics of sand, the fineness modulus, coefficient of uniformity and mean effective size, when the screen analysis was plotted in that way. One interesting slide showed two filter sands plotted. They had the same coefficient of uniformity but different effective sizes, and hence the curves were parallel.

In the discussion that followed some engineers present said the tendency was toward more rapid filtration with a coarser filter sand, as plants relied less on filtration and more on chlorine for freeing the water from bacteria. But filtration was still important, as the last of the turbidity had to be removed before the chlorine became effective. Mr. Prince said a coarser filter sand with a low uniformity coefficient could be made, but it would cost more, as there would be so much less of it in the sand that came from the river.

Regarding sewage filtration sand, the engineers said that the specifications had been drawn as broad as possible to include any local sand that would serve the purpose. The conditions for sewage filtration were very different from those of water filtration. In water filtration there was an upward flow of 10 to 15 g.p.m. per square foot of area; in sewage filtration the flow was 90 gallons per hour per acre. So sand that would do for sewage filtration could not be considered for water filtration. The main purpose of sewage filtration was rather to spread out the material over a large acreage and purify it by exposure to the air.

However, one of the engineers admitted that sewage filtration was easier where the sand used approached a real filter sand, and he read a letter from a state board in which one of three samples, all submitted by the Stewart Sand Co., had been selected because it was nearest to a filter sand. Mr. Prince said that if the engineers would tell him what they wanted for a sewage filtration sand, and the price they could afford to pay for it, his company would be glad to make a sand as near to their requirements as the price would allow.

Crushed Stone Production Shows Good Increase in 1926

Estimated That Output Will Pass 120,000,000 Tons in Spite of Bad Weather and Other Local Set Backs

THE crushed stone industry in the United States produced 122,000,000 tons in 1926. This estimate is based on the reports of producers from all parts of the United States. Weighted averages of percentages of increased and decreased production show an increase of 11½% over 1925 production, and the figures for 1925 were obtained from previous estimates checked by the reports of the Bureau of Mines and by other reliable statistics.

Weighted averages applied to the output of what are considered to be representative producers show the division of the product to be as follows:

Railway ballast	13.0%
Concrete aggregate	30.5%
Highway materials other than concrete aggregate	31.0%
Flux stone	22.0%
Agricultural limestone	2.6%
Miscellaneous specialties	0.9%
	100.0%

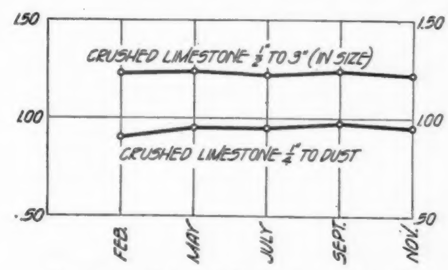
The plant price, taken as an average, remained remarkably steady. There were wide variations reported from different localities; 23% of the producers reported an increased price and 18% a decreased price, while 59% said there was neither increase nor decrease. Increases and decreases so balanced each other that the actual decrease shown was less than 0.1%.

Increased tonnage was reported by 58% of the producers, the percentage of increase running from 1% to 400%. The greatest decrease in tonnage reported was 50% and the least decrease 1¼%. Both decreases and increases are scattered over the country and there is no section which does not show both increases and decreases. Of the producers reporting *increases* 34% were from the northeastern states, 16% from the southern states, 24% from the central states, 19% from the western and southwestern states and 7% from the Pacific coast. Of the producers reporting *decreases* 22% were from the northeastern states, 26% from southern states, 22% from central states, 26% from the west and southwest and 4% from the Pacific coast.

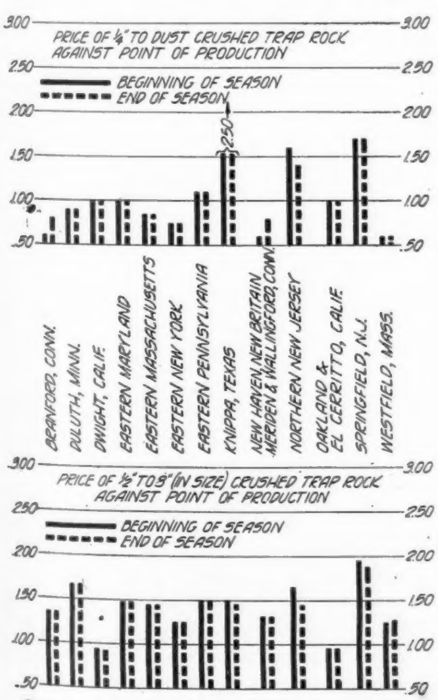
Quite naturally, with such an increase in production and so large a number of producers reporting increases, conditions for 1926 were considered good by a large percentage, 80% of the whole, while 11% admitted they were just fair and 9% said they were bad. Labor conditions practically everywhere were very good. Wayside pit competition was nowhere considered very serious and an overwhelming majority of producers said that the tendency was to demand better materials.

Prospects for 1927 are considered good but not so many producers reported good prospects for 1927 as those who reported good conditions in 1926. Seventy-six per cent reported prospects good; 20% said they were fair and 4% said they were bad.

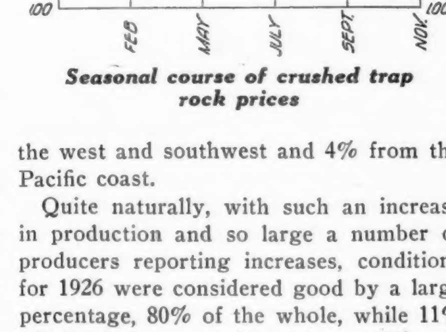
The reasons given for good conditions in 1926 and for anticipating good conditions in 1927 were, first, road work (59%), second, general construction (29%), and the remainder (12%) gave many reasons, among which were the conditions in the steel industry and other industries, and railroad building.



Seasons showed little variation in crushed limestone prices



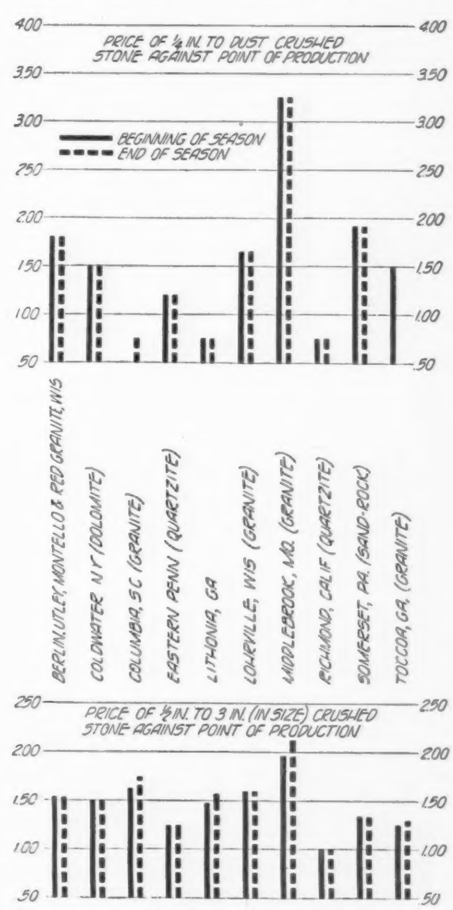
Crushed trap rock prices at various shipping points



Seasonal course of crushed trap rock prices

Results of Engineering Research

This is the first year that a Bureau of



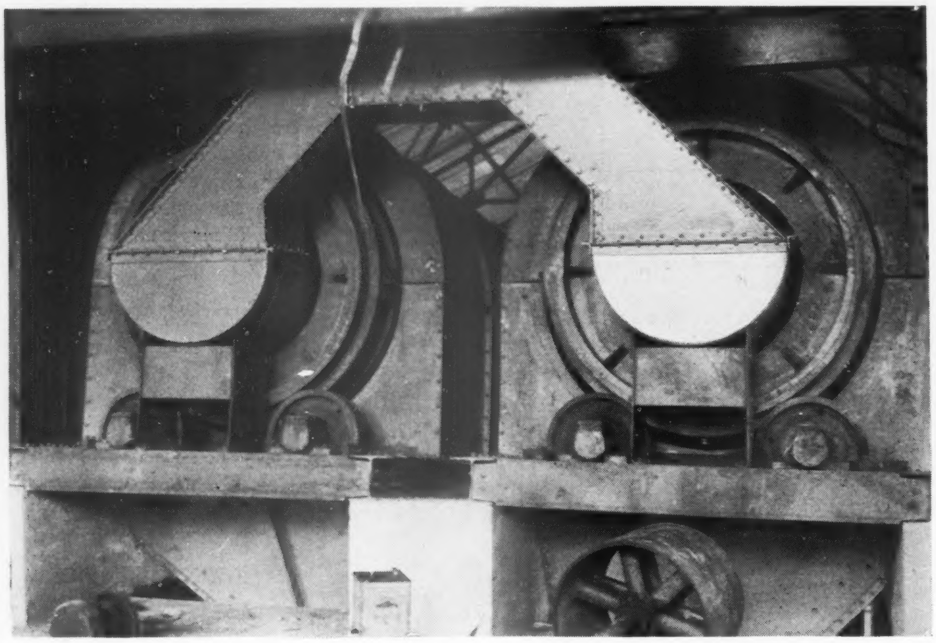
Prices of miscellaneous crushed stone at shipping points

Screening plant on storage silos at Tomkins Cove Stone Co.'s Haverstraw plant

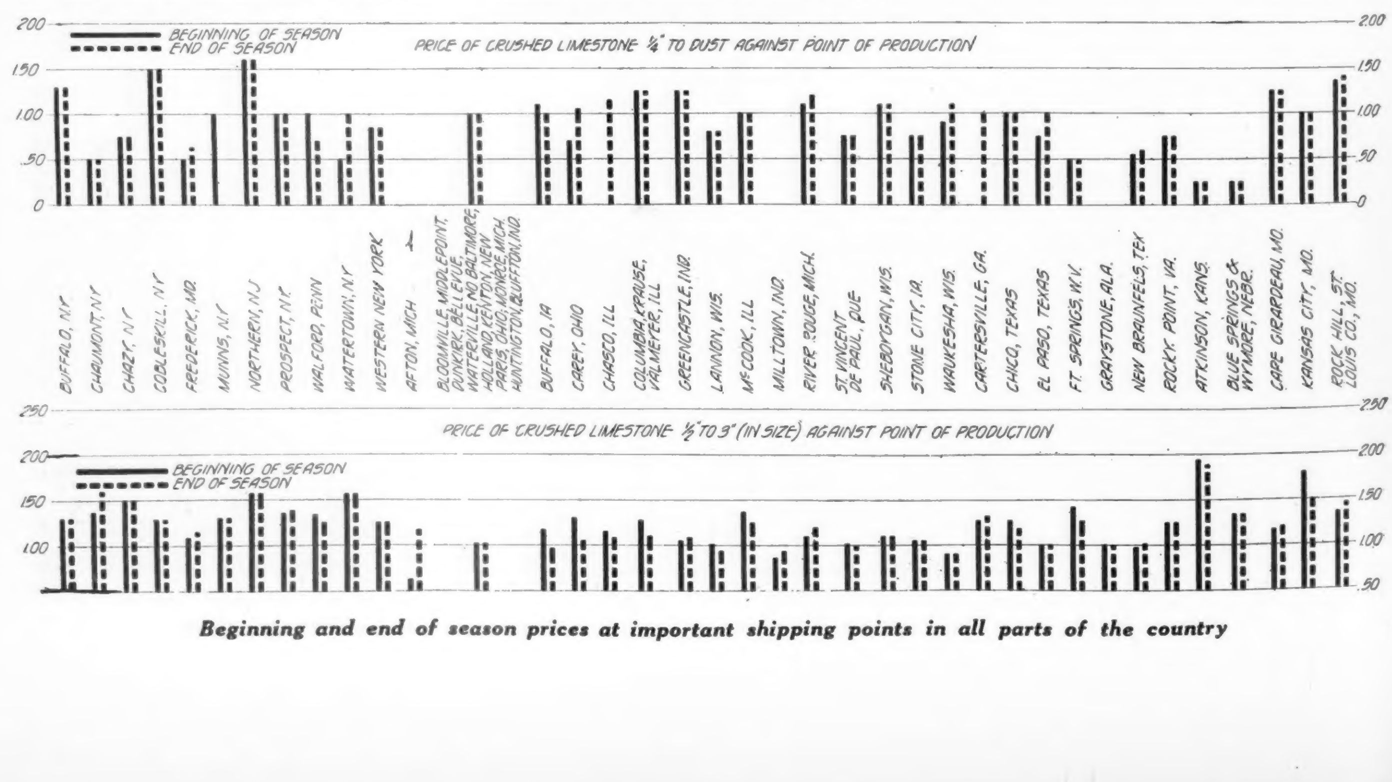
Engineering and Research nas been maintained by the National Crushed Stone Association and the results under the direction of A. T. Goldbeck have fully justified the establishment of the bureau. This research has followed several lines but especially two, one the development of the bituminous type roads and the other the development of the advantages of crushed stone as a concrete aggregate.

A study of the design of bituminous types of roads has been made and sections of the most successful types in service have been analyzed and suggestions made as to their betterment. Much of this work was incorporated in a paper read before a meeting of the National Research Council held in Washington in the early part of December. Mr. Goldbeck pointed out that flexible types of roads were not easy to study in the laboratory and hence they had not received the attention that had been given to rigid types. Hence his paper began at the beginning, showing how weight and impact were transmitted over an increased area in a properly designed road and from this he developed designs and analyzed other designs in use. This paper and his articles in the *Crushed Stone Bulletin* have awakened a new interest in roads of this character. It is significant that the knowledge of how to lay bituminous types of roads by highway engineers was reported by a producer as one of the needs of the industry.

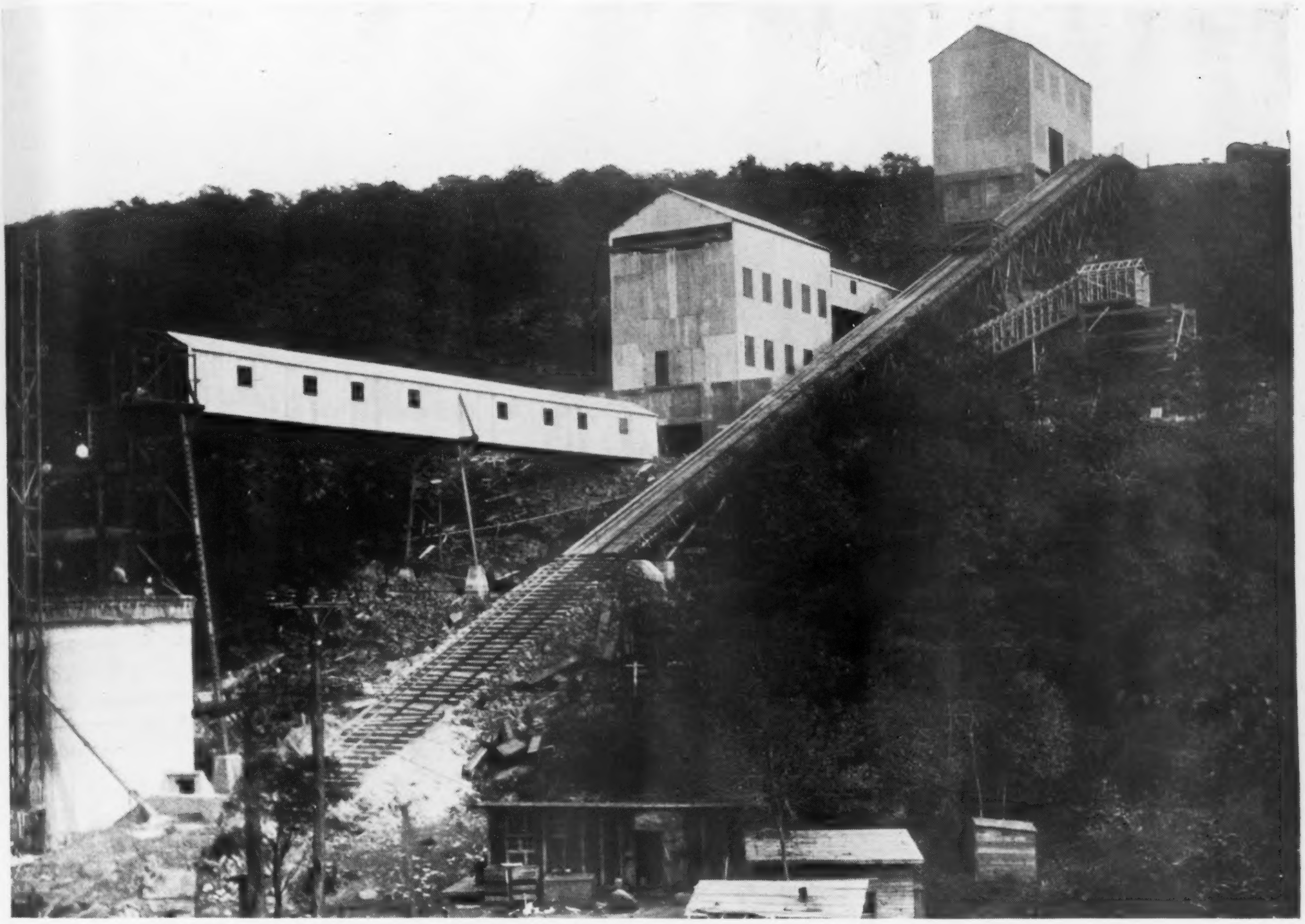
In concrete Mr. Goldbeck's work has brought out that while study has developed such basic principles as the water-cement ratio, and something of the effect of grading, a great deal remains to be done on types of aggregate. It is coming to be believed that the value of aggregate expressed by the fineness modulus is subject to considerable modification for the type of aggregate used. For this reason certain types of aggregate, such as crushed stone, are believed to have special advantages when used in a special way. As an example, the use of what was formerly considered to be an excess of fine aggregate with crushed stone has given some excellent results, and it is possible that admixtures of the fine gravel, 3/8-in. and 1/2-in. that is a waste product



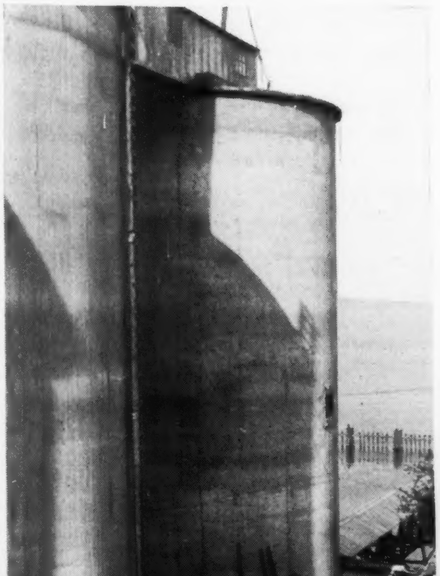
Steel chutes and screen protection in Tomkins Cove company's new plant



Beginning and end of season prices at important shipping points in all parts of the country



The three crushing department of the Tomkins Cove Stone Co.'s new plant at Haverstraw, N. Y. This and the other pictures of this plant were taken during construction



Storage silos at Haverstraw plant which are 28 ft. diameter and 60 ft. high. Note size of man at base

with gravel producers in so many parts of the country may have some advantages.

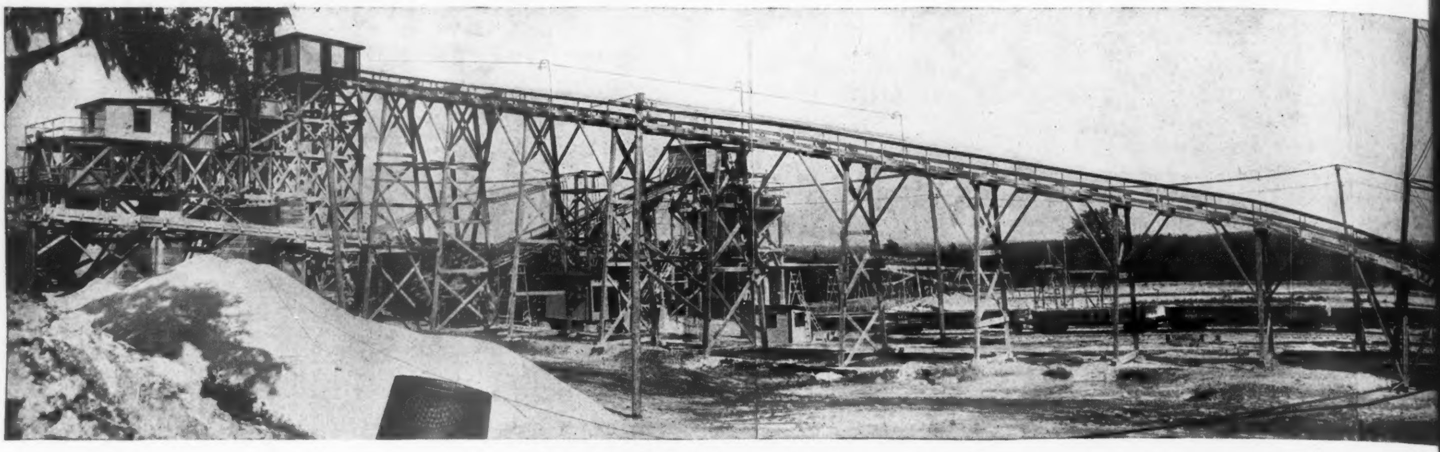
Bad Political Conditions

It would be unfair to the industry as a whole not to mention that several producers reported that bad political conditions had seriously decreased production in some localities. There is danger that this may spread, as in some states there is a movement to take highway building out of the hands of state highway commissions and put it back into the hands of local commissions and boards, which long experience has proven to be fruitful fields for the growth of petty politics and personal jealousies and prejudices.

Progress in Plant Design and Equipment

The most notable plant of the year is that built for the Tomkins Cove Stone Co., Haverstraw, N. Y., by the Burrell Engineering and Construction Co. In some ways it is the most remarkable crushed stone plant

Pulling steel from a horizontal hole at Haverstraw quarry of Tomkins Cove Stone Co.



Plant of Consolidated Rock Products Co. at Brooksville, Fla. The stone occurs in

yet built. A complete description will appear in an early issue, so it will not be described in detail here.

It will be noted that this plant is of the type in which the crushing units are really parts of a conveying system so that the transportation and crushing of the material is an unbroken process and the material passing the last of the screens is at the loading point, in this case a considerable distance from the quarry. Transportation by conveyor belts has been brought to such perfection in late years that this is not only possible but also economical as compared with other methods.

The same general idea was used in the design of the Verplanck quarry plant of the New York Trap Rock Corp. which was built by the same engineers and which was described in detail in the Annual Review and Directory number for 1925. This plant has since been enlarged to produce 8000 tons a day and this was possible without very much difficulty because the original plant had been planned with a view to later enlargement. Both plants are models of construction, steel and concrete being used everywhere. The pictures show some of the neat steel construction of chutes and like parts in connection with the screen installations.

A similar design, so far as the basic idea is concerned, was used in the plant of the Peerless Quarries, Inc., at Oriskany Falls, N. Y. The engineering for this plant was by the company which, as the Dale Engineering Co., maintains an engineering staff. The plant was described in detail in the issue of August 21. The plant of the Consolidated Rock Products Co., Brooksville, Fla., is designed to wash the Tampa limestone which occurs in boulders in a lime-clay formation. Series crushing is employed to prevent over-crushing. It will be described fully in a later issue.

In the way of new equipment probably the most important development has been that of high-speed crushers for making the finer sizes of stone. Two or three of these have appeared of which descriptions are given in the new machinery department of this issue. Some new screens have also appeared and descriptions will be found under the proper heading in the same department.

New pulverizing plant of the Marble Cliff Quarries Co., Columbus, Ohio

Marketing All the Product

Considerable progress was made during the year in the use of what were formerly considered waste products and by-products. The problem of what to do with screenings seems to grow less and less important each year. Several producers reported an increasing demand for the finer sizes from the manufacturers of concrete products. The great increase in the consumption of agricultural limestone that followed the campaign put on by producers in 1925, in connection with the farm bureaus of Illinois, has had a remarkably stimulating effect on agstone consumption. One large Illinois producer found that he was quite unable to supply the demand even at an increased price.

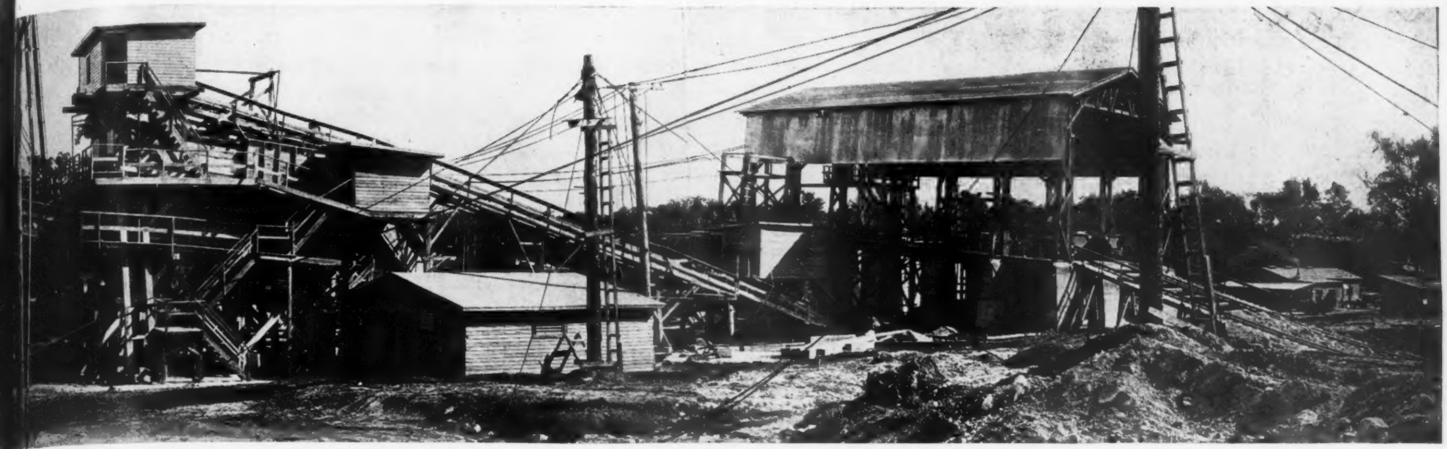
The Marble Cliff Quarries Co., which has been a leader in the manufacture of all that comes from the quarry into merchantable products, erected a pulverizing plant in 1926 for the grinding of screenings and other small sizes to several products, including whiting, asphalt filler and several grades of agricultural limestone. An unusual feature of this plant is the use of waste heat from the lime kilns which this company operates to dry the stone before pulverizing. The plant will be fully described in an early issue.

The same company has built a mixed mortar plant which uses the washed "limestone sand" made in large quantity and the lime from its own kilns. The limestone sand is screenings which have been thoroughly washed to free them from clay and dust. The product sells readily for all building purposes for which natural sand is used.

In the following survey of the industry the country has been divided into districts, the grouping being made largely with respect to marketing conditions and general business conditions.

Northeastern States and Ontario

This district includes Ontario, New England, New York State and City, Pennsylvania, and New Jersey, and it is in this district that the demand has been heaviest, and



a clayey matrix and this plant is designed to scrub and wash it very thoroughly

from it the largest percentages of producers has reported increased output. The New York Trap Rock Corp., one of the largest producers, added crushers, screens, and handling equipment to the Verplanck quarry plant, described in the Annual Review number for 1925, and raised the output from 5,000 tons to 8,000 tons per day. This company has recently been consolidated with the Tomkins Cove Stone Co., the details being given in the news pages of this issue. The total output of the combined companies will probably be about 18,000 tons per day when the new Tomkins Cove Company's plant at Haverstraw gets into its stride. Both limestone and trap rock are crushed.

Another important consolidation was brought about by the purchase of the Birdsboro Stone Co., Birdsboro, Penn., by the John T. Dyer Quarry Co., of Norristown, Penn., as told in detail in the Jan. 23 issue.

Conditions throughout this district appear to have been almost uniformly good, although some producers reported decreased tonnages due to strictly local conditions. From Ontario one producer reported fair business for the first three months, very good business for the six months following, and then a decline. Another spoke of serious competition from wayside pit material, but said that business was good on the whole and prospects better on account of proposed railroad construction and road work. Bad weather delayed work in this producer's locality and that of others who reported.

From New England, one Massachusetts producer said that there was a need of boosting industry in general and that a way should be found to dispose of products now sold as waste at a better price. Another producer from this state says business would be better if road work could be planned for eight months' work instead of four. From Connecticut it was reported that demand from both road work and general construction was strong. The state will probably show increased production.

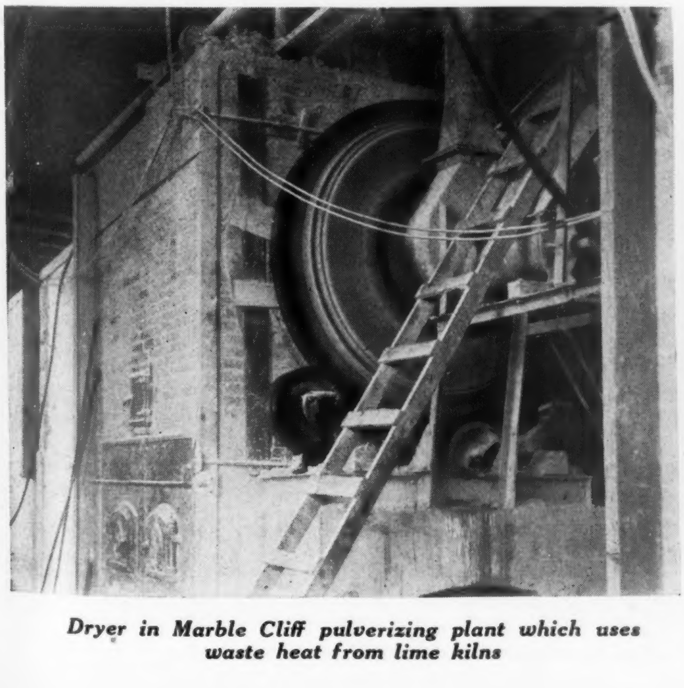
The demand for crushed stone from New York City was very strong this year, and in other parts of the state it was fairly good. One producer, however, reported the same production as in 1925 but on account of the slump in certain local industries he thought prospects were only fair. There was a good production in the western part of the state. Plants near Rochester and Buffalo reported that they could not keep up with the demand.

Pennsylvania producers appear to have had a good season, although one producer in the eastern part of the state said that a fairer price was needed for the quality of the material demanded. One New Jersey producer reported that all the plants in his section were running and better prices were expected.

The principal new construction in the industry was in this part of the country. The largest new plant is that of the Tomkins Cove Stone Co., mentioned elsewhere. Another important New York plant was that of the Peerless Quarries, Inc., described in the August 21 issue. The Lake Erie Lime stone Co. rebuilt its plant at Hillsville, Penn. A description was published in the Oct. 16 issue.

Southeastern States

This district includes everything south of



Dryer in Marble Cliff pulverizing plant which uses waste heat from lime kilns

Mixed mortar plant at Marble Cliff which uses washed limestone screenings for sand

Pennsylvania and east of the Mississippi river with the exception of Florida. The industry seems to have had a good year throughout this section, but prospects for the coming year are not considered to be so good by some producers who reported. Wayside pit competition was reported serious at one point in Tennessee. A North Carolina producer reported that price cutting had been carried to an extreme. One Kentucky producer said that there was a need for lower freight rates for distances under 150 miles and another reported that better roads ought to be built and better homes erected.

In Maryland one producer reported demoralizing conditions from "come and go" plants, and a West Virginia producer said that buyers should be educated to put quality above price.

The most notable new plant in this district is that of the Mathieson Alkali Works in Saltville, Va. George Patnoe designed it and superintended the construction. It produces kiln stone but no commercial material. The Fairmont Limestone and Sand Co. began work in the summer on a plant at Fairmont, W. Va., to produce ordinary commercial crushed stone and pulverized limestone for dusting coal mines. The Southern Limestone Co. was recently organized at Harriman, Tenn., to produce commercial stone and ballast.

In South Carolina the Weston and Brooker Co., Columbia, which is one of the largest producers in the South, had a plant destroyed by fire in August and is rebuilding it to have a capacity of 600,000 tons per year. In Georgia a new company, the Ainslie Lime Rock Co., was formed to work a deposit near Cochran. The Lithonia Granite Co., Cleveland, O., began operations in February at its quarry at Lithonia, Ga., which is near Atlanta. In Alabama the Alabama Lime Co., which has recently installed new kilns, began work on a plant to produce crushed stone. A number of other plants reported minor improvements.

Florida

There was a great deal of activity in Florida this year in spite of the collapse of fictitious real estate values which occurred early in the season and the damage done by the hurricane. The most notable addition to the producing facilities of the state was the Meteor Transport and Trading Co.'s dredge, *Magic City*, which was described in detail in the December 11 issue. A large crushing plant was built near Brooksville by the Consolidated Rock Products Co., which crushes the Tampa limestone. The Peninsula Rock Co., Orlando, was organized in July to work another deposit near Brooksville. The Mariana Lime Products Co. was organized in the early summer to work the Mariana limestone, especially for road stone, and recently it is reported that Connell and Schultz will build a new and larger plant on their holdings near Williston.

The greatest rock-crushing district in Florida is in and around Ocala, where about 20 plants of large capacity crush the soft Ocala limestone to make road material. Conditions at these plants were described in editorial correspondence published in March and April issues.

Central States

This group includes the states north of the Ohio and east of the Mississippi. It probably produces the heaviest tonnage of any of the districts given here due to the fact that two companies operating in these states produce about 15% of the entire production of the country. There are many other large producers as well as these but it would be difficult to say whether production as a whole has decreased or increased for some of these reported heavy increases while a number reported decreases. Ohio production appears to have been about the same as in 1925, Indiana production is somewhat less and Illinois production is decidedly increased over 1925. Michigan and Wisconsin productions are somewhat better than last year's.

Of the Ohio producers, one of the largest reported that his company had had the best year in its history and expected good business in 1927. However, he felt that these could not be considered normal years. Another said he saw no reason for believing that next year would be better than normal and a third said that prospects were "doubtful." Another still said they were unfavorable. To offset this other producers, but of smaller outputs, reported prospects as fair, good and even very good. Throughout Ohio rainy weather late in the fall slackened shipments of agricultural limestone to a marked extent.

Only a few Michigan producers reported but these reported good increases in output. None of them wished to commit themselves as to prospects for 1927.

Almost all the Indiana producers reported slightly less business for such reasons as bad weather, "municipal bodies short of money, on account of objection to high taxation," the political situation in certain localities and strong gravel competition. One producer, however, said the demand in his locality was changing from gravel to stone and he reported a good business. More road building is expected, and one producer wrote "Pray for good weather!" in answer to what he thought the greatest need of the industry. Another said that the greatest need was for engineers who know how to lay bituminous type roads.

All Illinois producers reported heavy increases in production, such as 20%, 25%, and 33%. Prices were decidedly lower, reports running from 5% to 10% below the 1925 price. *"Price cutting was terrible,"* wrote one producer, and he underscored it for emphasis. The increased production was made in spite of bad weather that interferred with general construction and shipments of agricultural limestone. Prospects are considered good but almost all producers said that this depended on the release of the $100,000,000 voted for road bonds, or at least a part of it.

Wisconsin producers who reported said that their tonnage was increased and the outlook for 1927 was good. One producer spoke of serious competition from county and municipal production.

Screening system and washing plants over bins at the plant of Peerless Quarries, Inc., at Oriskany Falls, N. Y.

Probably the most important new construction in this district was the building of the Monroe (Mich.) plant of the France Stone Co., Toledo, which takes the place of the plant burned last year. It was described briefly in the Oct. 2 issue. The Ohio Blue Limestone Co. was reported to be installing an Edison roll crusher and conveying equipment in October. The Michigan Limestone and Chemical Co., Rogers City, Mich., was recently reported to be building a machine shop, 125 by 240 ft. The Reliance Whiting Co., East Alton, Ill., installed a water flotation system in its pulverizing plant.

In Milwaukee the city crushing plant is said to have made improvements that will double the output.

West of the Mississippi

The states between the Mississippi river and the Rocky Mountains had a better year than would be indicated by the reports of poor general business conditions which have been coming from these states in the past year or two. For example, all but one or two of the Minnesota producers reported increased production and some of the increases were large. But none of these seemed to consider that prospects were any more than fair. Complaint was made by one Minnesota producer that the methods of the highway commission seemed to foster development of local pits and quarries with temporary plants. More paving and railroad construction are looked for in the coming year.

In both Iowa and Nebraska some producers reported increased production and a better price and others decreased production and a lower price. A part of those reporting from Iowa thought prospects good but a majority said nothing of good prospects. Nebraska producers generally thought prospects good and one producer said they were very good as compared with conditions for the past five years. He also noted a disposition of buyers to turn from gravel to crushed stone.

Missouri producers in the eastern and central part of the state reported some increases in production; in the western part they reported decreases. The decline in Kansas City and vicinity of general building, from the high figures reached in 1925, accounted for this. An interesting feature of the industry in this locality is the continued increase in mining stone instead of quarrying it. Underground methods have succeeded in producing an excellent quality of stone at a reasonable cost.

The crushed stone plant of the Missouri Portland Cement Co. at Sugar Creek, Mo., went into production the first week in January. It was described in the April 3 issue.

In Oklahoma production appears to have declined although this state was not very fully reported. Prospects for 1927 are considered excellent, especially on account of the good condition of the oil industry.

From Texas every producer but one (and he produces only flux stone) spoke of the bad political situation and the bad weather. Most producers reported decreased production. Pit run competition seems to have been especially serious in some parts of the state. Prospects are considered just fair.

Arkansas was not well enough reported so that either conditions of 1926 or the prospects for 1927 may be given here. The White Cliffs deposits were sold to the Lime Products Co. which is reported to produce pulverized limestone. The Big Rock Stone Co. of Little Rock, one of the oldest stone producing companies in the United States, purchased the sand business of the Southern Materials Co. and changed its name to the Big Rock Stone and Material Co. It was recently reported that the Blue Trap quarry at Little Rock was to be re-opened. The Batesville Marble Quarries Co. bought the Pfeiffer quarry at Batesville and made substantial improvements.

Rocky Mountain and Pacific Coast States

There is little production of crushed stone in the Rocky Mountain states and the 1926 record appears to be about that of 1925 from the few producers who reported. A large increase was reported from a plant near Denver, however, where business conditions are said to be very good.

Along the Pacific Coast crushed stone production seems to have held its own and no more, not because there was not enough construction to offer a market but because gravel, much of which is really crushed rock, is so much cheaper to produce. In Vancouver, B. C., however, a producer reported a very good increase and said that it was reasonable to expect an increase in 1927.

Washington produces very little crushed stone. In Oregon, Portland producers did about the same business as last year. One producer in another town reported a good increase and excellent prospects for the coming year.

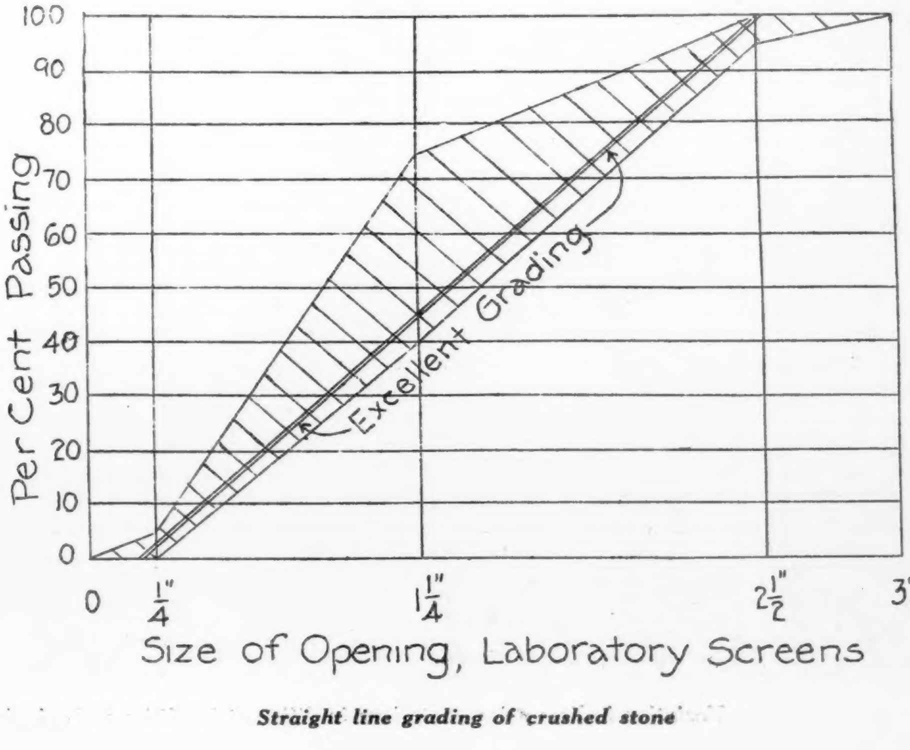
California producers reported both increases and decreases in production and increases just about balanced the decreases so it is assumed that the state's production was about the same as in 1925. All producers, however, reported that they considered prospects good, or at least fair, for 1927.

The Kaiser Paving Co., Oakland, Calif., started a plant at Black Butte, Calif., which made a large production, especially of railway ballast.

Straight Line Grading of Crushed Stone

IN a recent *Crushed Stone Bulletin* supplement, A. T. Goldbeck, director of the Bureau of Engineering of the National Crushed Stone Association, discusses the grading of crushed stone that will produce the densest and strongest concrete. He points out that specifications for stone generally allow a wide range in the amount of intermediate sizes which may be present. These have been made for practical and commercial reasons. But every producer will want to know the *best* grading for concrete coarse aggregate and this was long ago determined by Fuller and Thompson to be the "straight line grading" shown in the diagram, which has not been displaced by later investigation. Any grading which falls within the shaded area shown in the accompanying diagram would not only make a strong concrete but would give the greatest amount of concrete for a given amount of cement.

Mr. Goldbeck thinks that further laboratory studies should be made along the line of determining the best grading.



Straight line grading of crushed stone

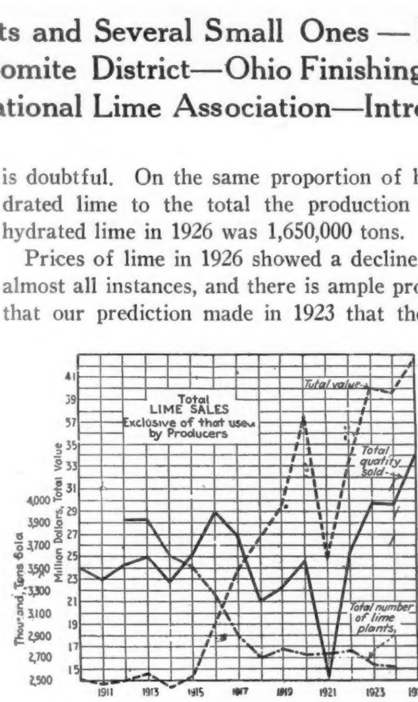
The Lime Industry Grows in 1926

Three Notable New Plants and Several Small Ones — Plant Capacities Increased, Particularly in Ohio Dolomite District—Ohio Finishing Lime Association Founded —Changed Policies of National Lime Association—Introduction of Pulverized Lime

THE new life and growth of the lime industry evidenced in 1925, when production increased 11% over production in 1924, seems to have continued during 1926. Reports from producers in all parts of the country show estimated increases in production from 62% of those reporting, averaging 22%; 17% of those reporting estimated an average decrease in production of 15%, and 21% of the producers reporting had approximately the same tonnage in 1926 as in 1925. This gives an average increase distributed over all those reporting of about 11%. This is not a weighed average, and we know that some of the very large operations had about the same business they had in 1925. Therefore, we believe a conservative estimate of the increase in 1926 lime production over 1925 production was about 9 or 10%.

The total production of lime in 1925, according to the U. S. Dept. of Commerce figures, was 4,510,000 tons. Therefore our estimate of 1926 production is approximately 4,960,000 tons, or very close to 5,000,000 tons. About one-third of the total in 1925 was hydrated lime—1,505,000 tons. Possibly in 1926 a slightly larger proportion of the whole was hydrated lime, although, as pointed out further along in this article, this is doubtful. On the same proportion of hydrated lime to the total the production of hydrated lime in 1926 was 1,650,000 tons.

Prices of lime in 1926 showed a decline in almost all instances, and there is ample proof that our prediction made in 1923 that there would be a slow but steady decline in prices over a considerable period was correct. It is believed, however, with some exceptions, that lower prices have been offset by increased efficiency and lower costs, and that profits have been in general about as good as a year ago.

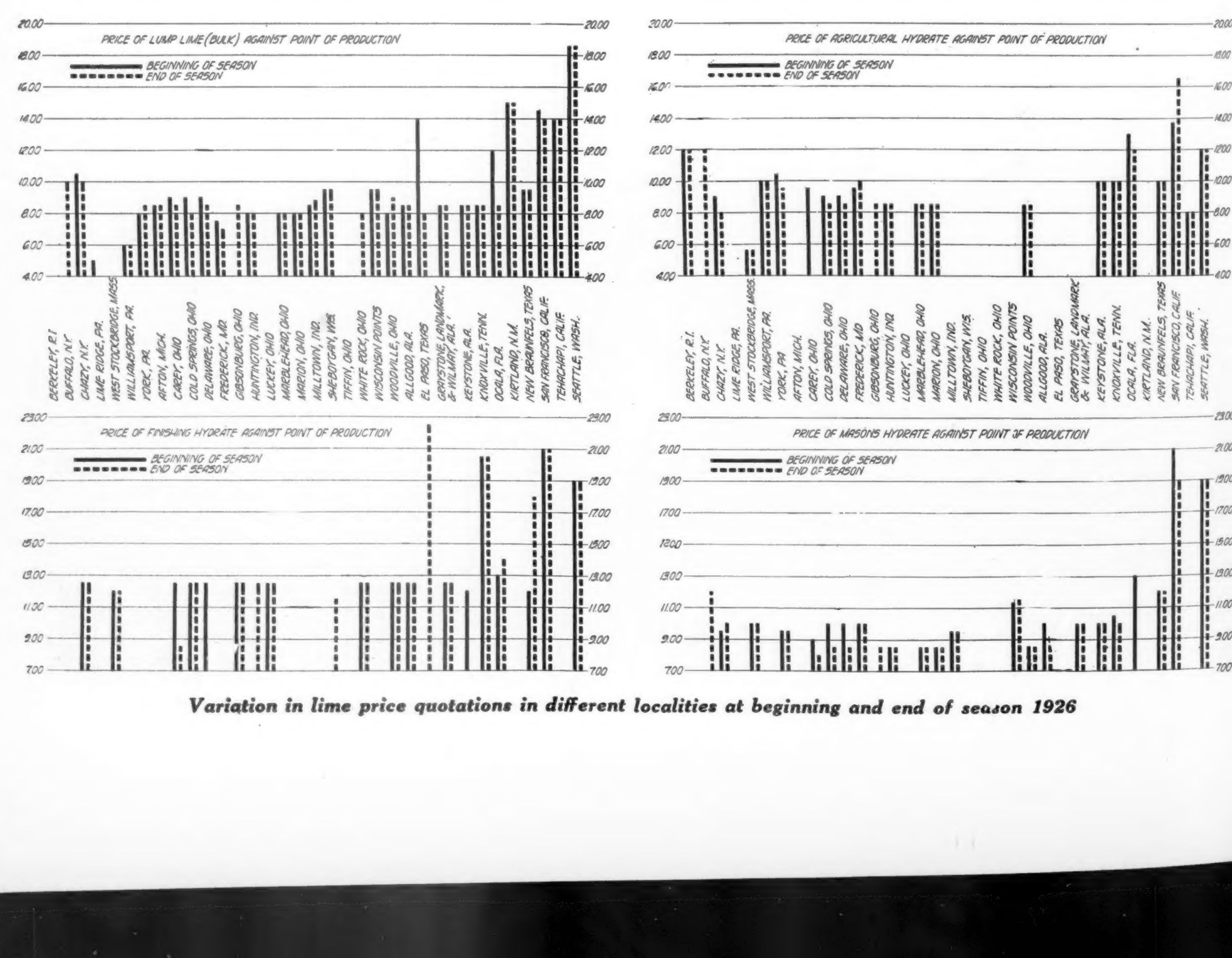


Graph illustrating decrease in number of lime plants and increase in lime production, 1910-1925

From Chemical and Metallurgical Engineering (December, 1926)

Of those producers reporting, 11% reported price increases averaging 8%; 50% reported price reductions averaging 7%; and 39% of the producers reporting said prices in 1926 were approximately the same as in 1925. This gives an average decrease in the selling price of lime in 1926 as compared with 1925 of about 2.6%. The average price received at the plants in 1925, according to the U. S. Department of Commerce figures, was $9.43 per ton. On the basis of our figures the average selling price in 1926 has been 25 cents per ton less or $9.18 per ton for lime and $9.92 and $9.67, respectively, for hydrate. This is slightly more than a similar decrease in prices in 1925 as compared with 1924. It will be noted that this is lower than the average quotations as published currently in ROCK PRODUCTS. The difference, we presume, is accounted for by cash discounts and dealers' discounts, uncollected accounts, etc., not taken into consideration in the regular quotations.

A year ago we asked producers to estimate their expectation of business in 1926, and their average prediction was 20% over 1925,

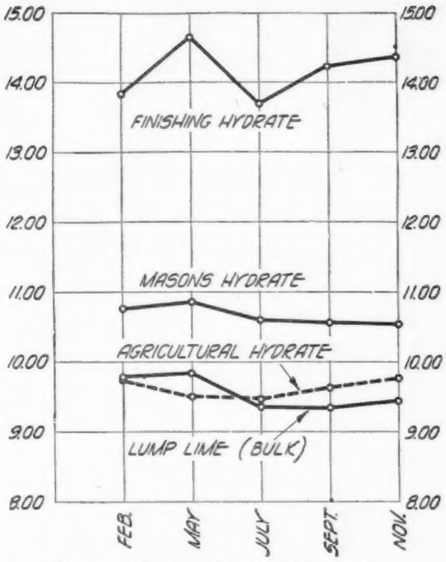


Variation in lime price quotations in different localities at beginning and end of season 1926

but we cut this in half and predicted a 10% increase, which now seems to have been about right. This year we did not ask for predictions on 1927 production, but we feel safe in stating that the lime industry is in a more healthful state than for several years past, and that there is every reason to believe the steady growth of about 10% per annum during the last two years will be maintained for at least another year, barring unforeseen unfavorable developments.

To provide for the expected increase in business this year (1926) 39% of the producers reported plant capacities increased by an average of 26%, while the remaining 61% reported no changes in plant capacity. Assuming that these are representative returns for the industry as a whole, the increase in producing, or manufacturing, capacity in 1926 was about 10%, *exclusive*, however, of entirely new operations. New operations, which first began production in 1926, have added a producing capacity of probably 200,000 tons per annum, or something like 4% of the 1926 production. In other words, producing capacity in the industry increased about 14% in 1926 and consumption increased about 10%.

To provide for expected increases in consumption (and production) in 1927, producers representing 36% of those reporting are increasing their plant capacities by an average of 34%, while the remaining 64% of producers contemplate no changes in productive capacity. Pro-rated among the entire group this represents a contemplated increase in plant capacity for the lime industry as a whole in 1927 of about 12% of 1926 production. This does not take into account



Seasonal variation in lime price quotations

projected new plants referred to later.

Reports from a few Canadian lime manufacturers show conditions about the same as in the United States, with a slightly larger increase in consumption and less price reduction, as compared with 1926, than in this country.

There was increased consumption of lime in 1926 over 1925, both for building construction and industrial uses. The increase in the use of lime in building construction is probably accounted for by the higher class of construction in 1926 as compared with 1925—apartments, hotels, office buildings, etc.—rather than in a larger volume of building construction as a whole. Probably the largest factor in the increased consumption of lime was, and will continue to be, its growing use in water softening, trade-waste treatment, etc.

In answer to the questions, "What was the outstanding development in the lime industry in 1926?" and "What fields offer the best prospects for increased use of lime?" some typical answers were as follows:

Eastern Seaboard

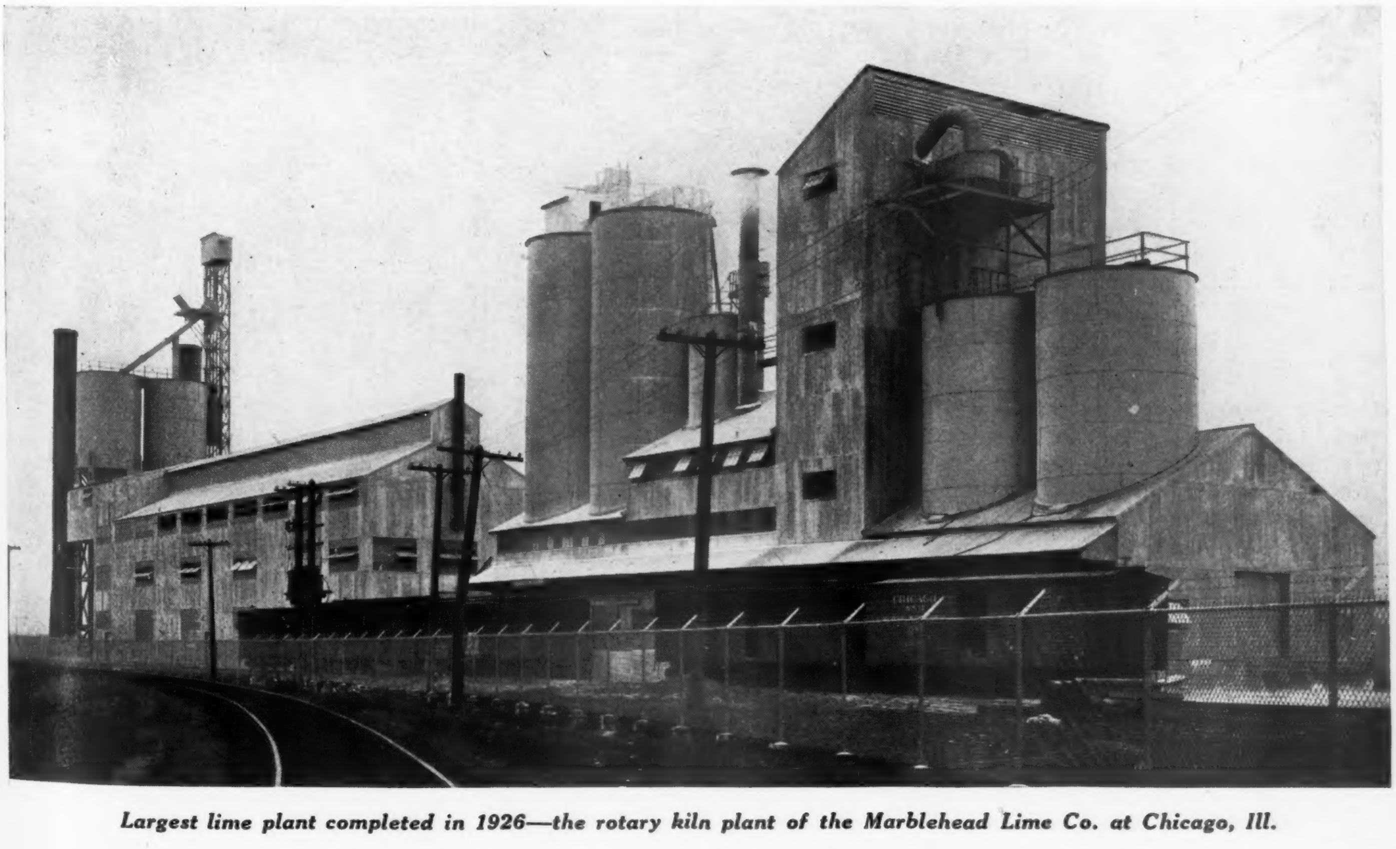
"Eastern structural markets changing to hydrate."

"A tendency toward overproduction and lower prices has brought about a feeling of necessity for amalgamations, or the formation of larger groups of producers under one management. The best prospect for lime consumption is in mortar for straight lime and cement-lime mixtures."

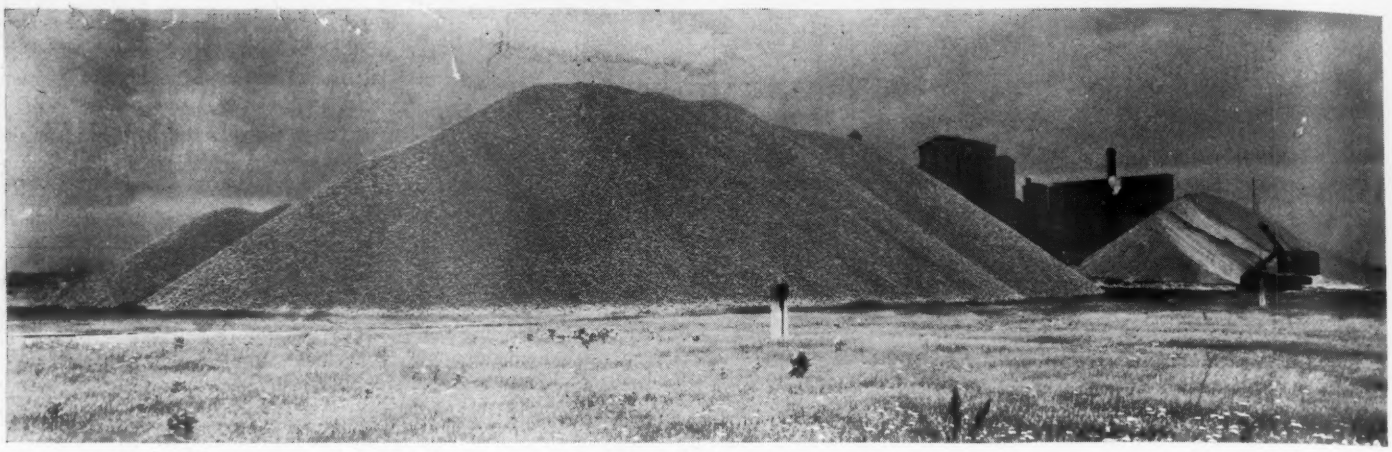
"Get back the plaster market."

"A settling down to rock-bottom prices and a demand for higher quality than ever before. Best prospect for the increased use of lime is in concrete work."

"The outstanding development in the lime industry in 1926 was the consciousness that quality must be maintained and improved wherever possible, and that the consumer must be educated more and more to the merits of good lime products, and then he will blame less all lime because of the failure of some one lime for his purpose. Pulverized lime is a development of the above consciousness, with the idea of making a failure impossible. It may or may not be the answer, but it has increased the use of lime to some extent and standardized its application.



Largest lime plant completed in 1926—the rotary kiln plant of the Marblehead Lime Co. at Chicago, Ill.



Limestone from Calcite, Mich., stocked at Marblehead Lime Co. plant

Agriculture offers the best prospect for the increased sale of lime and with the least expense to bring about increased tonnage. Lime mortar and lime plaster offer excellent prospects, but as long the cement and gypsum industries are as profitable as they are today, the lime manufacture will find it hard to raise sufficient funds to place lime in the position with the public it is entitled to have."

Central West

"Pulverized lime probably eliminates cores and popping in plaster. Beyond this we see a disadvantage to offset every supposed advantage. Best prospects for increased use of lime is for the treatment of city and trade refuse."

"Lump lime is coming into use more and more for both mortar and plaster. Lime is in demand for agricultural purposes where the haul is long, in preference to agricultural limestone."

"Have observed no marked demand for pulverized lime. Of new uses we believe the best prospect is in the treatment of trade wastes.

Far West

"In our territory the use of hydrate is slowly replacing quick lime."

"Our greatest need in the industry today is live men; better products; more efficient production; advertising."

Technical Progress

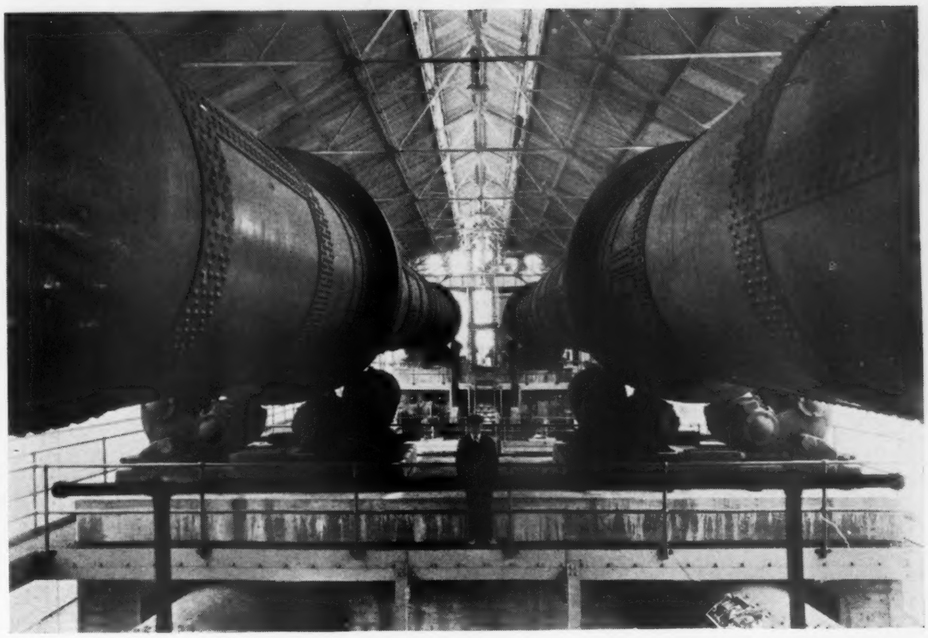
Several things stand out as evidence of technical progress; first, there are at present 16 chemists employed in the lime industry in as many plants. This is evidence of an increasing interest on the part of manufacturers in the quality control of their product. Thus far such scientific control has consisted largely in physical and chemical analyses of the limestone and the lime in order to insure a product of uniformity, or a product especially suited to some large use. Little has been done in the way of attempting scientific control of the manufacturing operation itself, because means and methods have always been lacking for determining and controlling all the variables which enter into the operation of a lime kiln as a calcining machine capable of complete control.

One may compute the theoretical amount of air needed for combustion, the amount of fuel necessary or desirable for best results, the desirable flue-gas analyses and temperatures, the correct amount of steam to use, or no steam at all, and a host of other variable factors in kiln operation; but accurate and sure means of controlling all these factors simultaneously are never present. Therefore, one of the greatest achievements in the lime industry in 1926 is the progress made in this direction at the plant of the Blue Diamond Co., Los Angeles, Calif., by William H. Barton under the personal encouragement and supervision of W. C. Hay, president of the Blue Diamond Co. Both of these gentlemen are well known in the lime industry for past accomplishments. Mr. Hay is the originator of the "Blue Diamond"

Hydrator and lime bins at Marblehead Lime Co. plant

process of lime putty manufacture and the "Blue Diamond" mortar mixing plant and process. Mr. Barton is a former general superintendent of the lime plants of the Ash Grove Lime and Portland Cement Co., and is one of comparatively few technically educated and trained lime-plant engineers.

There are many interesting and unique features in connection with the experimental kiln of the Blue Diamond Co. at Los Angeles, which we will describe in detail in a subsequent issue. Here we merely wish to point out that a kiln has been constructed which is subject to accurate scientific control, and that by means of indicating and recording instruments the kiln operator does control the kiln much as a locomotive engineer controls the performance of his locomotive. These instruments, illustrated in an accompanying view, include a recording pressure gage for the natural gas fuel; a registering gas meter, or gasometer, a CO_2 indicator, a pyrometer indicating temperatures at top of stack and over the gas inlets; a kiln-draft gage and an indicating pressure gage for the gas burners individually.



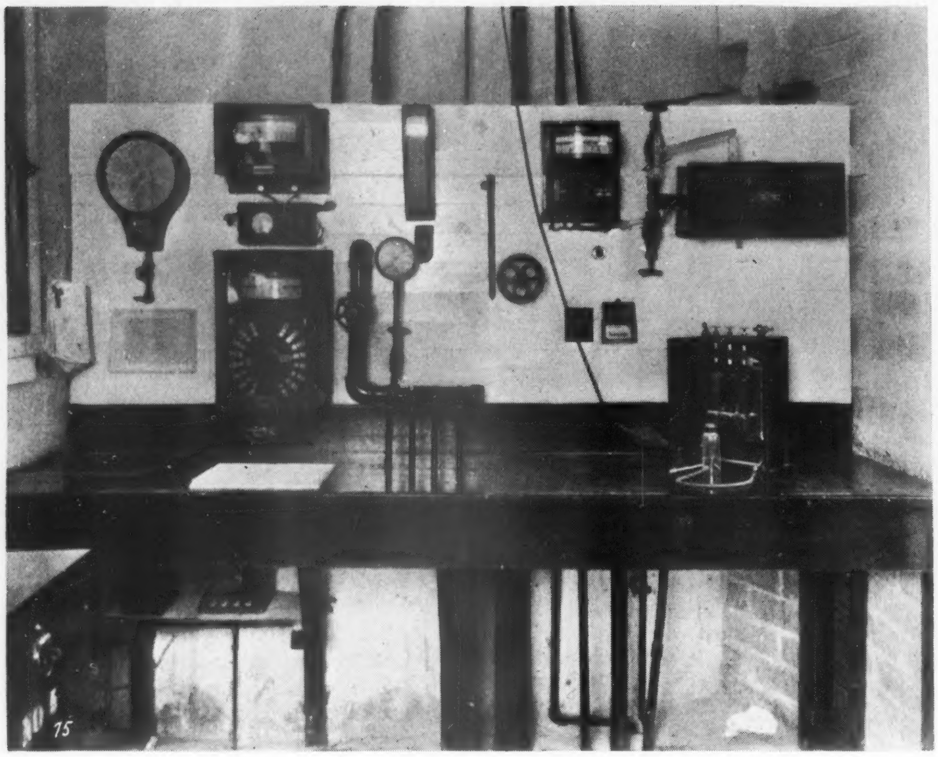
Kilns at new Marblehead Lime Co. plant

Another interesting development in the industry in 1926 was contributed from New England by George B. Wood, president of the Rockland and Rockport Lime Corp., Rockland, Me. This is a fibred pulverized quick lime for plaster. A full account of this new product, and of the growing market in the East for pulverized lime, was published in ROCK PRODUCTS, October 16, 1926. During the past few years, including 1926, there has been a considerably greater growth in the use of hydrated lime than in the growth of lime consumption in general. This tendency may be altered by the further development of pulverized lime.

The results of a thorough-going investigation of the possibilities of the Dwight and Lloyd ore-sintering machine for calcining limestone were made public in 1926 (ROCK PRODUCTS, July 10, July 24, 1926.) These investigations were made by Dwight and Lloyd, well-known metallurgical engineers, New York City, in co-operation with the U. S. Bureau of Mines. They proved that this machine can be developed into a continuous calcining device to burn small sizes of limestone, with an installation cost of

New experimental kiln of the Blue Diamond Co., Los Angeles, Calif.

How lime is drawn from new Blue Diamond Co. kiln at Los Angeles



Control board of Blue Diamond Co. kiln

about one-third that of a rotary kiln with the same capacity. Up to this time, however, there is no commercial operation using these machines for lime burning.

Another technical development in the lime industry, and one that bids fair to have a very great influence on the efficiency of ordinary shaft kiln operation, is the new type of furnace or firebox placed on the market by Arnold and Weigel, lime plant engineers and manufacturers, of Woodville, Ohio. Although placed on the market as a mechanical stoker for lime-kiln furnaces, it really introduces an entirely new idea in furnace construction and operation. The device itself is known as the Ward stoker, invented by Wilburt Ward, when he was with the St. Genevieve Lime and Stone Co., St. Genevieve, Mo.

To perfect this stoker and to solve other operating problems of lime manufacture Arnold and Weigel have built a model lime plant at Woodville, with a standard kiln and hydrating plant on a scale of one-third actual size. Views and details of this plant are shown herewith. Its building undoubtedly constitutes one of the important steps in the solving of many practical problems in lime plant operation. This kiln is equipped with two full-size Ward stokers which, incidentally, illustrates their flexibility. These stokers have already been installed on standard size kilns at the plants of the Kelley Island Lime and Transport Co., John Herzog and Son, Limestone Products Co., Menominee, Mich., and in other well-known plants in the Woodville district.

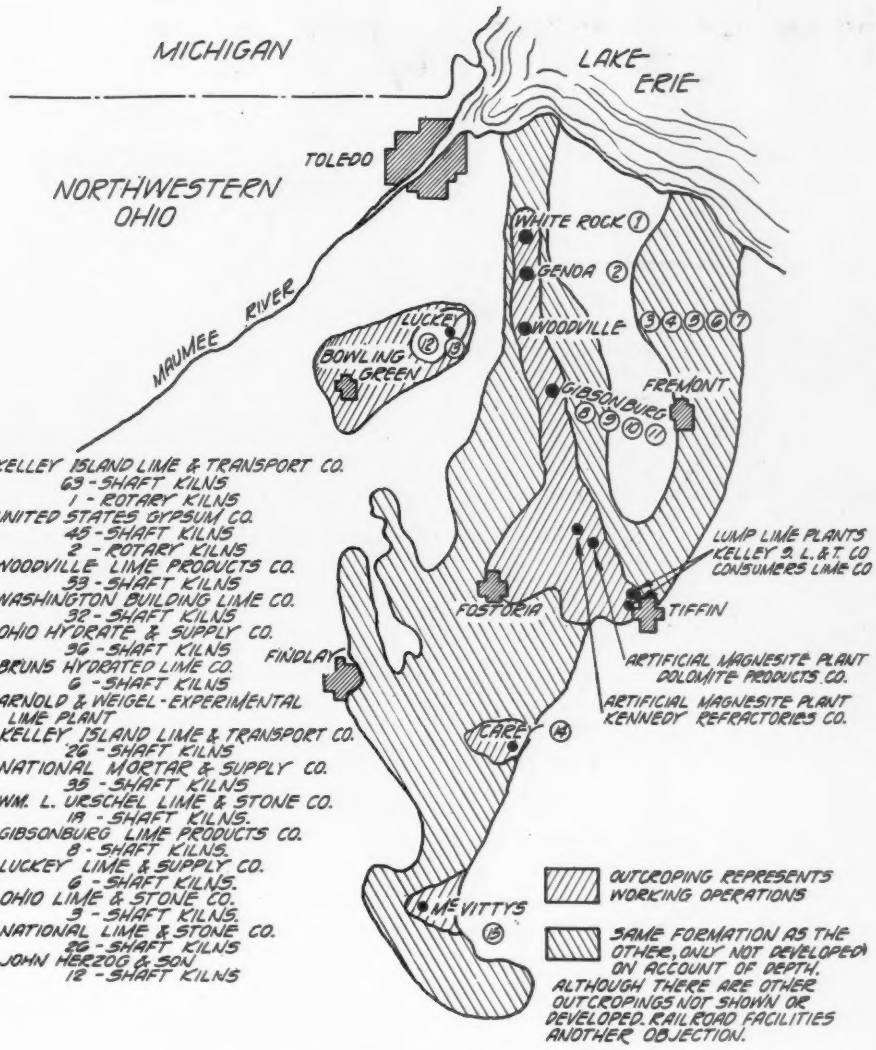
A description of the stoker is given elsewhere in this issue, under the heading, "Lime Kilns and Hydrators," in the general review of machinery and equipment developments in the industry in 1926. Suffice to say here, that it converts the furnace into an automatically stoked semi-gas producer with remarkably smooth and efficient operation. The coal is dropped, a few pounds at a time, on the fuel bed, well distributed by a cleverly designed four-quadrant valve, at any desired interval of time. The furnace has no grates. Steam is introduced directly into the fuel bed, which serves to keep the bed

Another view of new Marblehead Lime Co. plant at Chicago

open as well as to make a gas probably more nearly allied to water gas than ordinary producer gas. Steam and air ducts are also provided into the sides of the fire boxes. Combustion is complete. Ashes are removed at long intervals by simply shoveling them out from under the live fuel bed, the bed bridging over temporarily, and subsequently dropping, or being slightly poked to make it drop.

The flame from these furnaces is the long, mellow type so much desired in lime burning. Drawing the kilns, as well as stoking the furnaces, is much simplified, for it is only necessary to shut off the fuel and steam for a short time. There is no drawing of the fires and cleaning of the grates, common under the present time-honored system. Moreover, the simplicity of the device, and the ease with which any lime kiln may be equipped with this stoker without extensive alteration, make it, in our opinion, a notable contribution to greater efficiency in lime manufacture.

Victor J. Azbe, consulting engineer, St. Louis, Mo., has continued his investigations and studies of lime burning and has done a great deal of original research, especially in connection with the effect of steam in lime-kiln and gas producer operation. The results of his work have been published from time to time in Rock Products, and we shall shortly have more data to publish. He has demonstrated quite conclusively to his own satisfaction that CO_2 gas from the kiln will serve more efficiently than steam in lime-kiln furnace and gas producer firing.

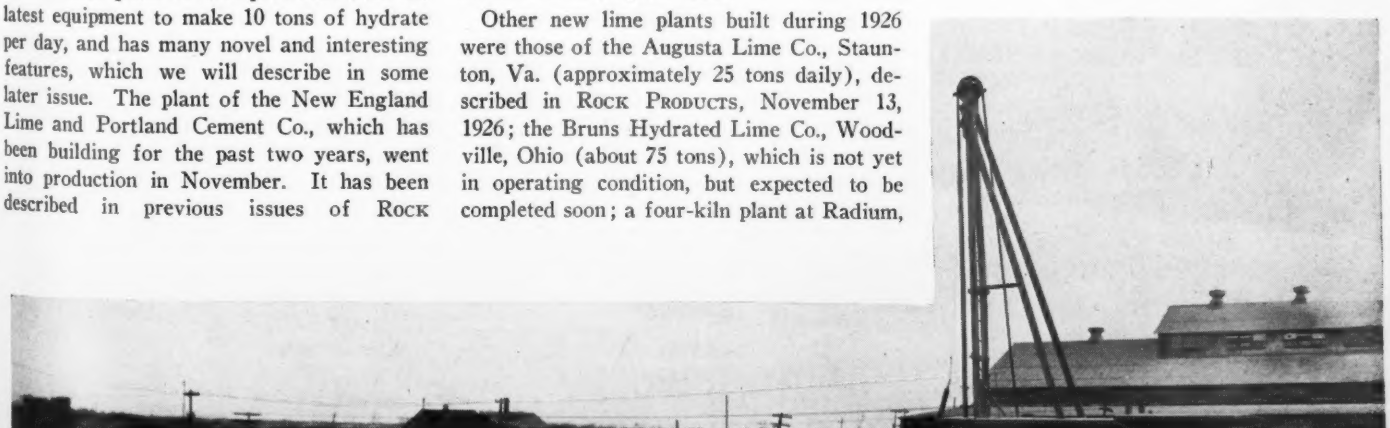


Map of the Ohio finishing lime district

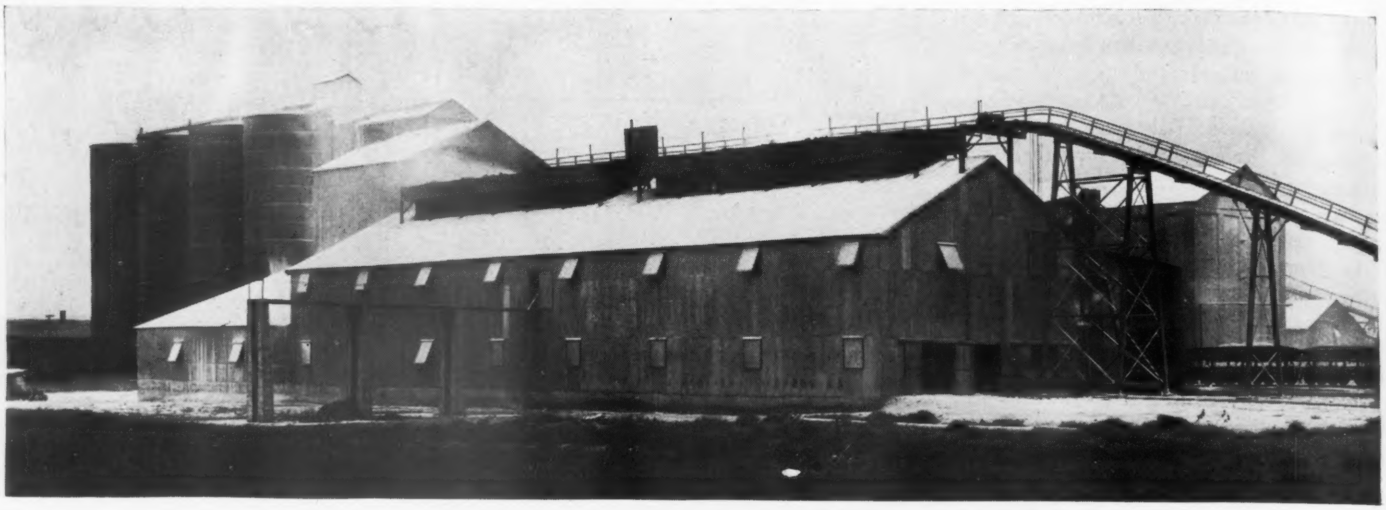
New Plants and Plant Additions

The two most notable new plants added to the lime industry in 1926 are undoubtedly those of the Marblehead Lime Co. at Chicago and of the New England Lime and Portland Cement Co. at Thomaston, Me. The Marblehead Lime Co. plant began operation in the spring with a production of about 250 tons per day from two 9 x 175-ft. rotary kilns. This plant is also provided with the latest equipment to make 10 tons of hydrate per day, and has many novel and interesting features, which we will describe in some later issue. The plant of the New England Lime and Portland Cement Co., which has been building for the past two years, went into production in November. It has been described in previous issues of Rock Products. It consists of two of the latest type Schaffer kilns, equipped with automatic stokers, and has a rated capacity of 80 tons per day. This plant will be described in detail in a subsequent issue.

Other new lime plants built during 1926 were those of the Augusta Lime Co., Staunton, Va. (approximately 25 tons daily), described in Rock Products, November 13, 1926; the Bruns Hydrated Lime Co., Woodville, Ohio (about 75 tons), which is not yet in operating condition, but expected to be completed soon; a four-kiln plant at Radium, Ariz., for H. E. Hoopes (about 50 tons); the Muscle Shoals White Lime Co., Muscle Shoals, Ala. (about 50 tons); the Sierra Lime and Minerals Co., Diamond Springs,



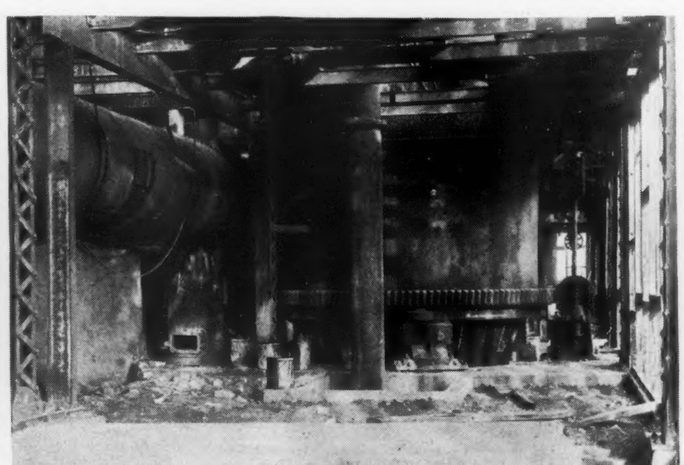
New plant under construction at Gibsonburg, Ohio, for the Gibsonburg Lime Products Co.



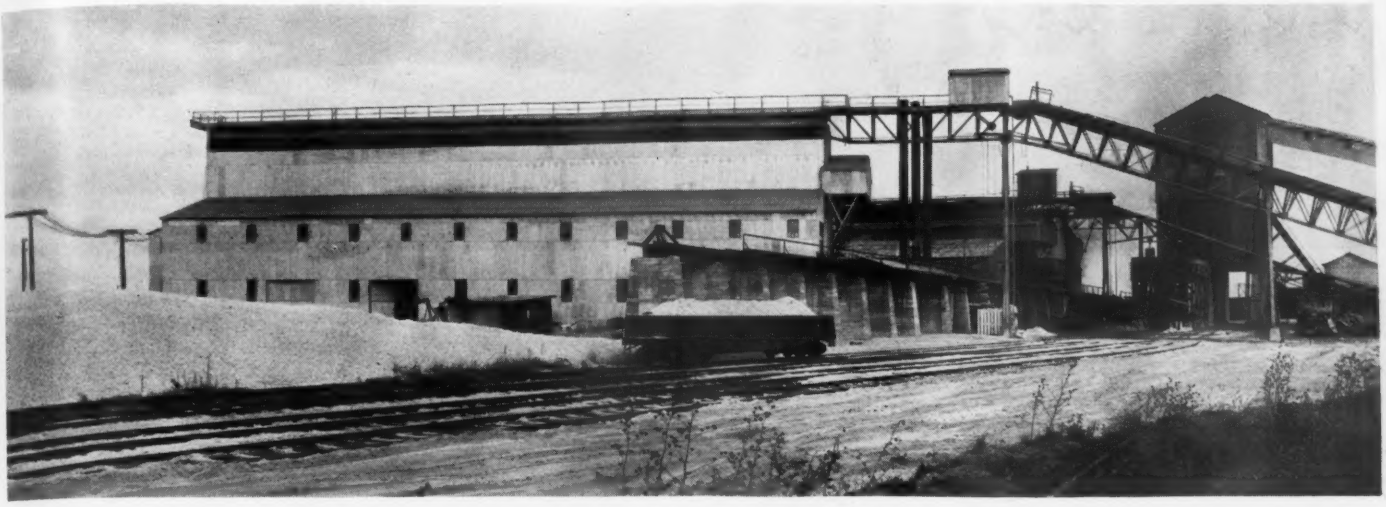
New kiln and storage bins of the Woodville Lime Products Co., Woodville, Ohio

New kilns under construction for the National Lime and Stone Co., Carey, Ohio

Construction work at Carey for National Lime and Stone Co.



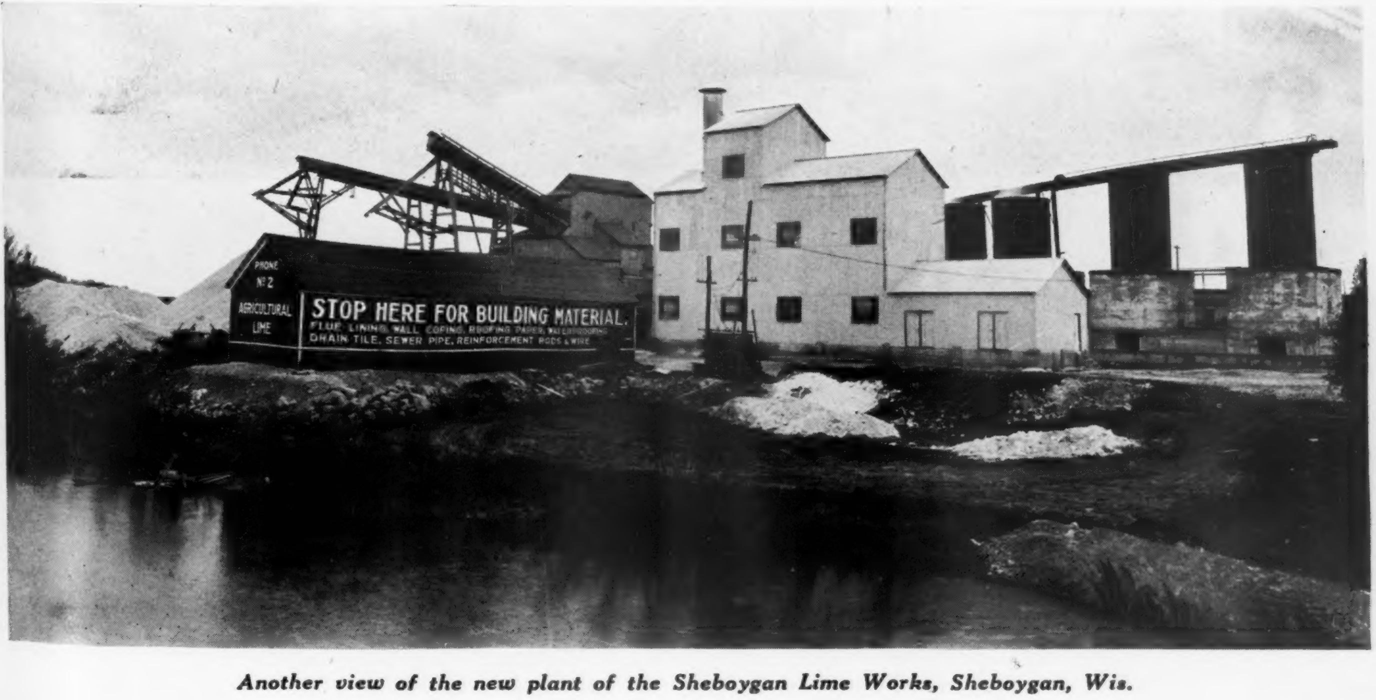
Gas producers for firing National Lime and Stone Co. kilns



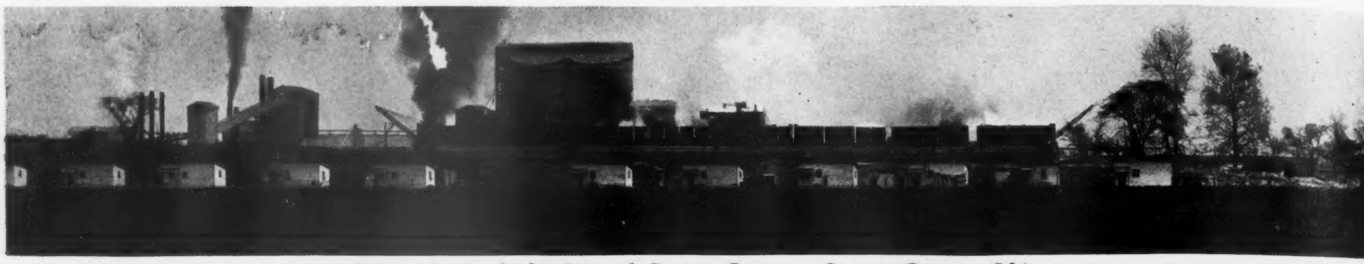
Battery of new kilns for the Ohio Hydrate and Supply Co., at Woodville, Ohio

Recently constructed plant of the Sheboygan Lime Works, Sheboygan, Wis.

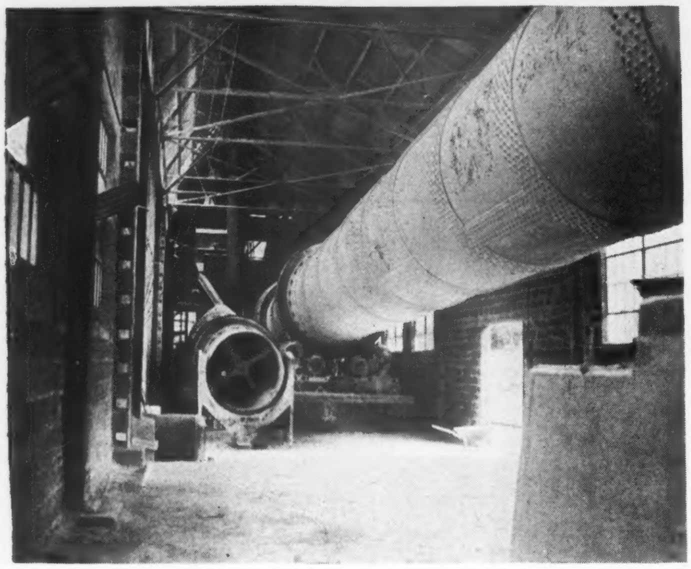
Enlarged rotary kiln plant and silos of Marble Cliff Quarries Co. lime plant



Another view of the new plant of the Sheboygan Lime Works, Sheboygan, Wis.

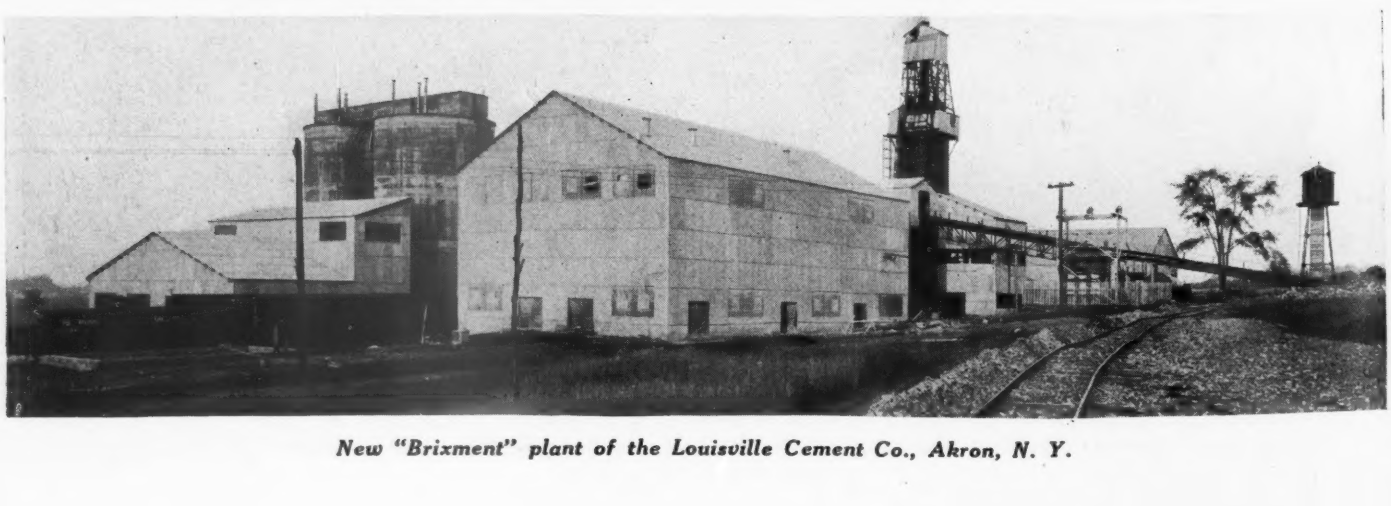


Lime plant of the United States Gypsum Co. at Genoa, Ohio

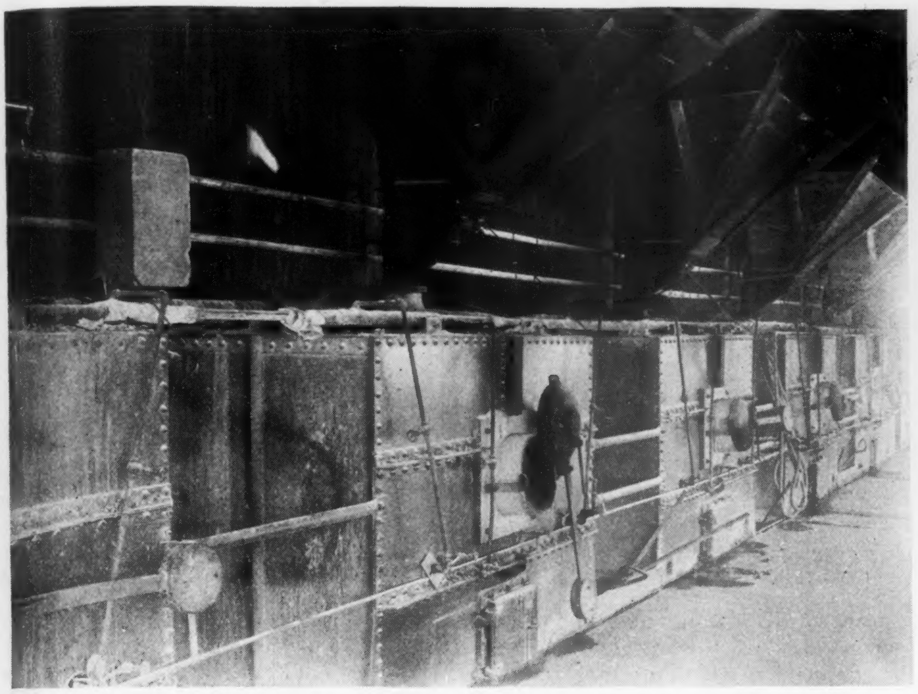


Two views of the No. 2 kiln of the American Lime and Stone Co.

New plant of the Bruns Hydrated Lime Co. at Woodville, Ohio



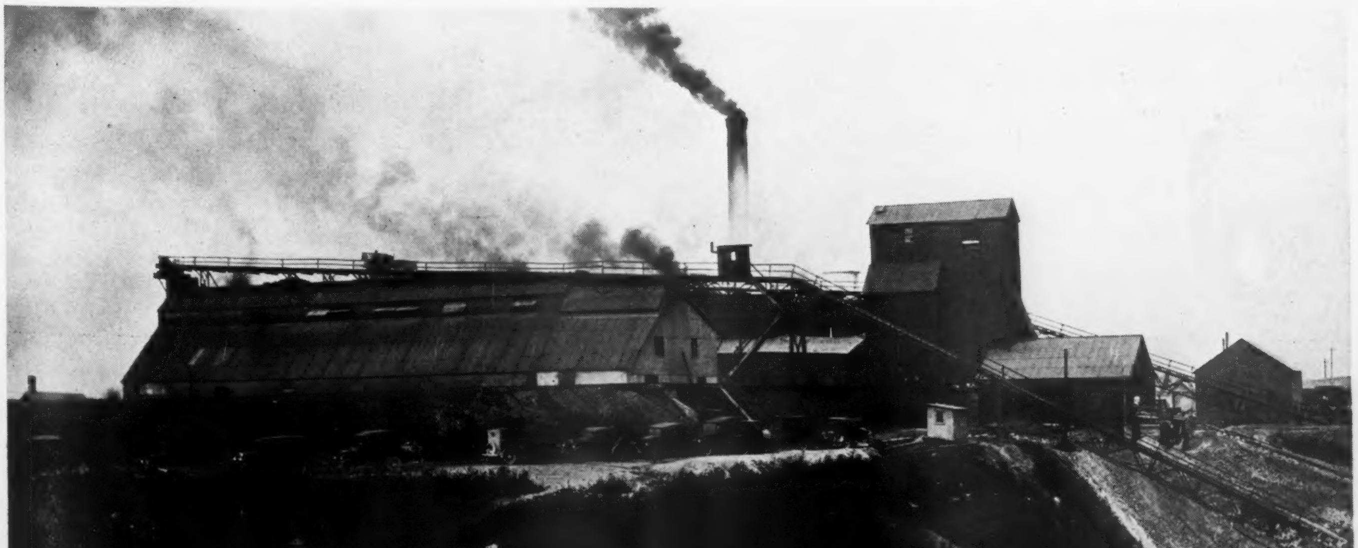
New "Brixment" plant of the Louisville Cement Co., Akron, N. Y.



Battery of kilns at John Herzog & Son plant at Forest, Ohio

New kilns at Gibsonburg plant of Kelley Island Lime and Transport Co.

Plant of the National Mortar and Supply Co. at Gibsonburg, Ohio



Kelley Island Lime and Transport Co.'s Gibsonburg plant

Experimental lime plant at Woodville, Ohio, belonging to Arnold & Weigel

Calif. (about 40 tons); Valley Lime Corp., Roscoe, Calif. (about 40 tons); the Southern Minerals Co., Winnfield, La. (about 8 tons). This list is probably not complete, but it accounts for a daily increase of producing capacity of about 620 tons, or a yearly increase of 200,000 tons.

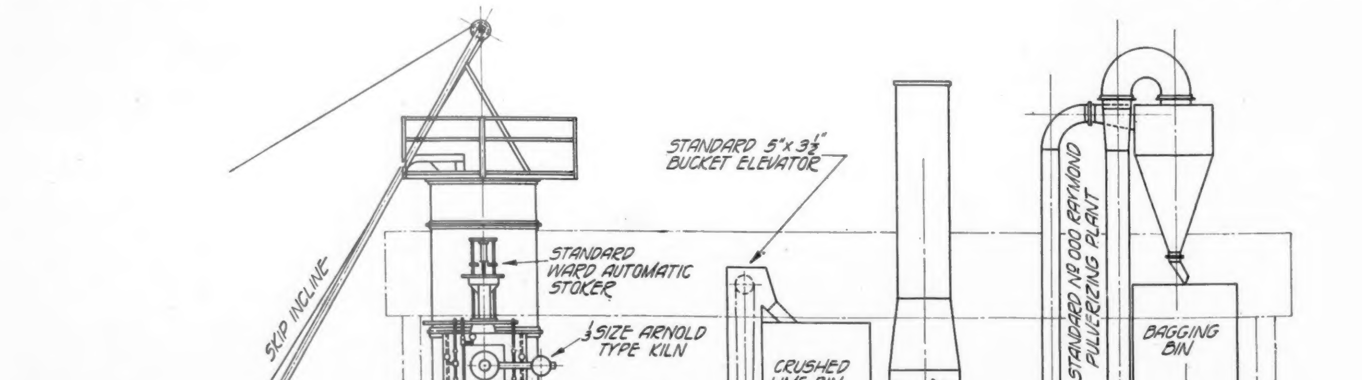
Projected Plants and Plants Under Construction

During the year we had records of 14 new incorporations in the lime industry, with a total capitalization of approximately $2,500,000. Some of these new organizations have plants that are reported to be under construction at the present time; among them are: a 25-ton (daily) plant at Sand Springs, Okla., for the Sand Springs Lime Co.; a four-kiln plant (about 60 tons) at Enterprize, Ore., for the Black Marble and Lime Co., and a 125-ton plant at Gibsonburg, Ohio, for the Gibsonburg Lime Products Co.

Expansion and Improvements at Existing Plants

There has been much activity at existing plants during the past year. The installation of the second 9 x 175-ft. rotary kiln at the plant of the American Lime and Stone Co., Bellefonte, Penn., was completed early in the year, adding about 125 tons daily capacity; the second 8 x 135-ft. rotary kiln installation (100 tons) at Columbus, Ohio, for the Marble Cliff Quarries Co., has been recently completed and put into operation (and a third kiln is in contemplation, we understand); the Limeton Lime Co., Front Royal, Va., replaced a plant destroyed by fire in April with a thoroughly modern one; the St. Joe Lime and Stone Co., Little Rock, Ark., took over the Moss de Voy Lime and Stone Co., and has made extensive improvements, including the addition of another kiln (16 tons) and a hydrating plant of 35 tons daily capacity; the New England Lime Co., Adams, Mass., has built a hydrate plant; the Sheboygan Lime Works, Sheboygan, Wis., has built a new hydrate plant (see Rock Products, February 6, 1926) with a capacity of 30 tons per 8-hr. day; and a new large operation, the Alabama Lime and Stone Corp., Calera, Ala., has a plant consisting of eight 40-ton Schaffer automatically stoked shaft kilns under construction.

The most outstanding improvements and expansions have taken place in the Ohio dolomitic lime industry. The United States Gypsum Co., the largest producer here, continues to add to its immense battery at Genoa. There were, when the accompanying view was taken recently, 40 shaft kilns and 2 rotary kilns, but there may be more at this writing. The shaft kilns are said to produce from 12 to 15 tons of lime per day each, or the plant has a total daily capacity of something over 800 tons—by far the largest lime plant in this country, and probably in the



Elevation of Arnold & Weigel's experimental lime plant

Interior of Arnold & Weigel experimental lime plant at Woodville, Ohio

world. The Woodville Lime Products Co., at Woodville, has during 1926 added a battery of 12 standard Arnold and Weigel kilns, increasing the capacity of the plant about 30%; new bins and other improvements have also been added; the Ohio Hydrate and Supply Co., Woodville, has also added a battery of 12 Arnold kilns, besides making extensive improvements; the National Mortar and Supply Co. has replaced a battery of 15 concrete kilns with the same number of steel shell kilns; the National Lime and Stone Co., Carey, Ohio, is now in the midst of erecting 12 new kilns and a hydrating plant; the Kelley Island Lime and Transport Co. has added four new Arnold kilns at Gibsonburg, and has made extensive improvements and increased the capacity of its kilns at Whiterock and elsewhere.

Association Activities

To take care of all this prospective production of the Ohio dolomitic lime industry the leading manufacturers there organized recently (see Rock Products, October 30, 1926) the Finishing Lime Manufacturers' Association of Ohio, which has an office and staff at Toledo and a growing force of field men for promotional and educational work.

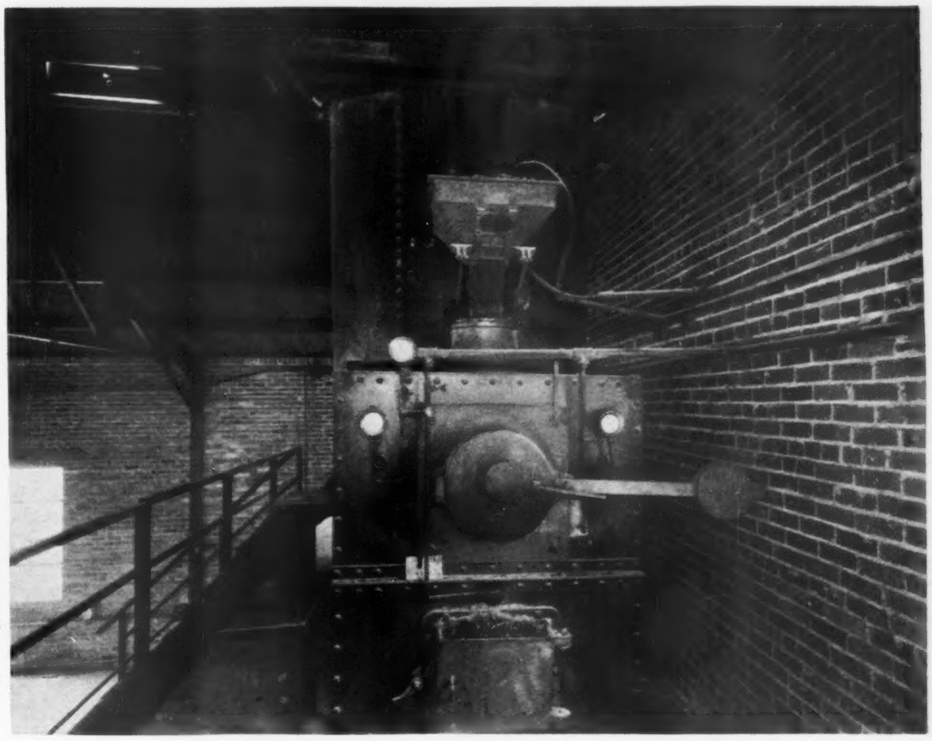
During 1926 the National Lime Association activities have been completely reorganized and much research work of more scientific interest than of practical value has been discontinued, and the energies of the Washington staff and field men devoted to more intensive field promotional work in industries which are already big users of lime, and bid fair to become larger users as a result of such promotional work. Several meetings of architects and engineers have already been held in parts of the country.

A New Use for Lime

HYDRATED LIME as a filler in asphalt mixtures produces higher stability values than equivalent amounts of the more commonly used materials, investigations conducted over the last three year by Prevost Hubbard and F. C. Field, of the Asphalt Association, disclose. These investigations were instituted because a greater resistance to displacement is necessary in order that bituminous mixtures may successfully resist the stresses to which they are subjected by modern traffic.

Summarized, the conclusions reached by the investigators based on their previous work and that presented in a bulletin by the National Lime Association, entitled "The Value of Hydrated Lime as a Filler in Asphalt Paving Mixtures," are:

1. Hydrated lime is a more efficient stabilizing agent in asphalt paving mixtures than is the average limestone dust filler when used in the customary percentage of the total mix.
2. No difference in the stabilizing value of different limes can be attributed to differences in chemical composition, i.e., whether the lime is high calcium or high magnesium.
3. The maximum stabilizing and void reducing effect of hydrated lime in paving mixtures containing a well graded sand appear to be obtained by the use of approximately 15% of lime.
4. In sheet asphalt paving mixtures with well graded sand it appears that about 13% by weight of hydrated lime is equivalent to 20% by weight of average limestone dust, and about 8% of lime is equivalent to 15% of limestone dust.
5. Hydrated lime appears to be better adapted for use with a relatively soft asphalt cement than is limestone dust, and when so used indications point to the production of mixtures of high stability at 140 deg. F. which are less likely to crack in cold weather.
6. Hydrated lime is an especially desirable filler for use with uniformly fine sand, and its superiority to limestone dust for such use may make available for sheet asphalt construction fine sands which are at present eliminated by specifications.



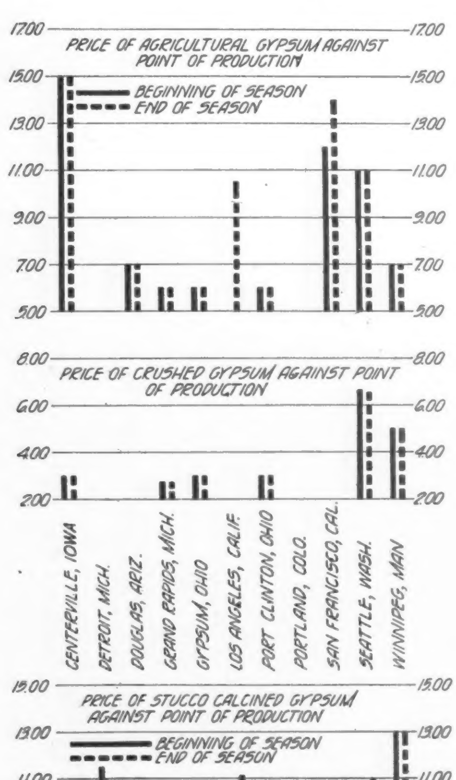
Arnold & Weigel experimental kiln at Woodville

The Gypsum Industry in 1926

New Products and Great Technical Development in Wallboard and Tile Manufacture

IN the way of new products, improved processes, etc., as well as growth in production, the gypsum industry continues to set a pace for all the rock products industries. Reports from producers indicate an increase in the total amount of gypsum mined in 1926 over 1925 of about 15%, or a total of about 800,000 tons, making the estimated production of crude gypsum in 1926 about 6,500,000 tons, as compared with 5,678,302 tons in 1925. There was an appreciable decrease in the selling prices of all gypsum products ranging from 5 to 10%, so that the percentage of increase in value of gypsum products in 1926 as compared with 1925 was not commensurate with the percentage increase in crude gypsum mined. In 1925 the total value of all gypsum products, as given by the U. S. Department of Commerce, was $47,893,573. The value of gypsum products in 1926, according to our estimates, was about 10% more, making a total of over $54,000,000 for the year.

Our records show 12 incorporations and corporate changes in the field of gypsum products manufacture in 1926, with a total capitalization of $20,000,000, including capital increases by going concerns. Probably not half of this total represents real money invested in new enterprises, or in improvements and expansions for going concerns. Besides several important new enterprises a great deal of new capital (not accounted for in the $20,000,000 above) was invested by going concerns. For example, a description of improvements and expansion by the United States Gypsum Co., published in ROCK PRODUCTS, June 26, 1926, includes a complete new plant at Detroit, Mich.; a paper mill at Ashfield, N. Y.; a specialty plant at Brighton, N. Y.; a new wallboard plant on Staten Island; many new warehouses; increases in mill and wallboard capacities at Sweetwater, Southard and Plasterco, averaging more than 50%. The latest news note on the activities of this company (December 11) announces the proposed erection of a $1,000,000 chip mill at Kansas City, Mo., to make wood chips or fibre for the wallboard mills in Iowa, Texas and Oklahoma. Altogether, we presume, this one company has invested more for new construction and expansion in 1926 than all the rest of the industry, perhaps in the neighborhood of $5,000,000 or $6,000,000.



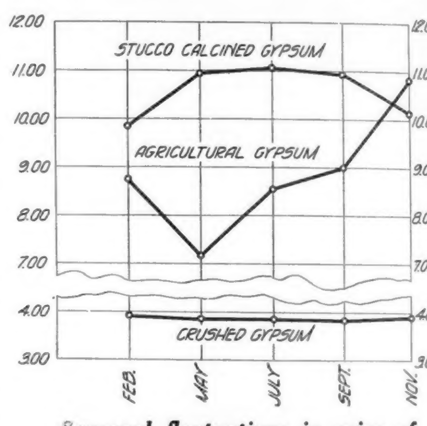
Price of calcined, agricultural and crushed gypsum against point of production

Other large producers in the industry, including the Universal Gypsum and Lime Co., the Beaver Products Co. and the Certainteed Products Co., have also made very extensive improvements. The Universal Gypsum Co., Chicago, in August, was merged with the Palmer Lime and Cement Co., New York City, and according to an announcement at that time, work was to have started at once on a new gypsum mill in Brooklyn, where all gypsum products will be made. The Beaver Products Co. has recently completed improvements and expansion at its Akron, N. Y., plant which alone total, according to published reports, $500,000. The Certainteed Products Co. has built a plaster board mill, and made other improvements at Acme, Texas, which are estimated to have cost $500,000.

In Canada, the Ontario Gypsum Co. has expanded by building a new mill and board plant at Montreal, Que., and is reported to have acquired gypsum deposits in British Columbia. The Manitoba Gypsum Co., Winnipeg, Man., through its subsidiary, the British Columbia Gypsum Co., has already entered the wallboard and products field on the West Coast with a plant at New Westminster, B. C. A large export business to New Zealand has already been created.

The West Coast of the United States has also shared in the expansion of the gypsum products business both for coast consumption and for export, although the growth of the industry here has not begun to compare with its growth in the East.

Of the new plants in the gypsum products industry the most notable is probably



Seasonal fluctuations in price of calcined, agricultural and crushed gypsum

that of the National Gypsum Co. at Clarence, N. Y., near Buffalo. This company built and put into production in the first half of 1926 what is unquestionably one of the best designed and most efficient plasterboard mills in the United States. (See ROCK PRODUCTS, October 2, 1926.) This one plant has a capacity of about 100,000,000 sq. ft. per year. Another new gypsum plant which was put into production late in 1926 is that of the Pennsylvania Gypsum Co., Chester, Penn., now equipped to make blocks and tile, but soon to be expanded to make wallboard as well. A third new gypsum enterprise in the east is the Atlantic Gypsum Products Co., Portsmouth, N. H., which has completed its calcining and wallboard departments, and will be ready to make block and tile in about two months. The foregoing by no means is a complete list of new operations, but it is typical of what is taking place in the industry.

There has been a considerable expansion in the mining of raw gypsum rock in Nova Scotia to take care of these new plants, and projected new plants, on the eastern seaboard. The New York state deposit on the line of Rochester and Buffalo is being further developed and its outer bounds are being continually explored and extended. The National Gypsum Co.'s mine is the most western at the present time and is only

10 miles from the city of Buffalo. Development work by the Victor Plaster Co., Rochester, N. Y., at Victor, N. Y., has shown that the same deposit extends east of that city, although there have been no operations so far east up to this time.

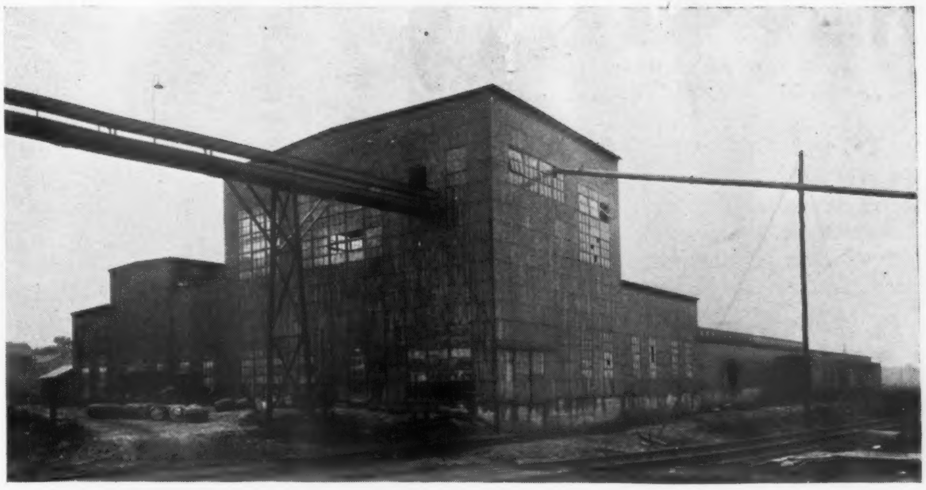
New Gypsum Products

The United States Gypsum Co. as usual, has led in the development of new products —at least in the number of new products. Gypsum sheathing, or "Gyp-lap," is now made with tongue and groove edges, exactly as wood sheathing; a gypsum lath is being marketed to compete with wood lath, and much progress has been made with a gypsum mixture of a dry flaky nature, which can be poured between studding, or between floors, for insulation against sound, as well as heat and cold. Acoustic, or sound deadening plaster, is another product recently announced, as well as a great variety of tinted plasters and stuccos. The use of gypsum concrete, or poured mixtures of gypsum and sawdust, or cinders, first introduced by the U. S. Gypsum Co. in 1925, is increasing rapidly for building construction.

However, all new products have not been developed by the U. S. Gypsum Co., for the National Gypsum Co. has devised a new mixture for wallboard manufacture which makes a stronger and lighter board than heretofore. A tongue and groove gypsum block has also been developed by an outside organization, the Gypsum Engineering and Manufacturing Co., which will be referred to later.

Technical Developments

Regular readers of ROCK PRODUCTS have been kept pretty well posted on technical developments in the gypsum industry during 1926, both through the series of articles by Alva Warren Tyler, and the descriptions of new plants, particularly that of the National Gypsum Co.'s new wallboard plant, in the issue of October 2, 1926. In the grinding of gypsum rock the use of the low side Raymond mill equipped with heavy rolls, wide-faced bull-ring, automatic feed control and improved vacuum air separator is spreading rapidly.



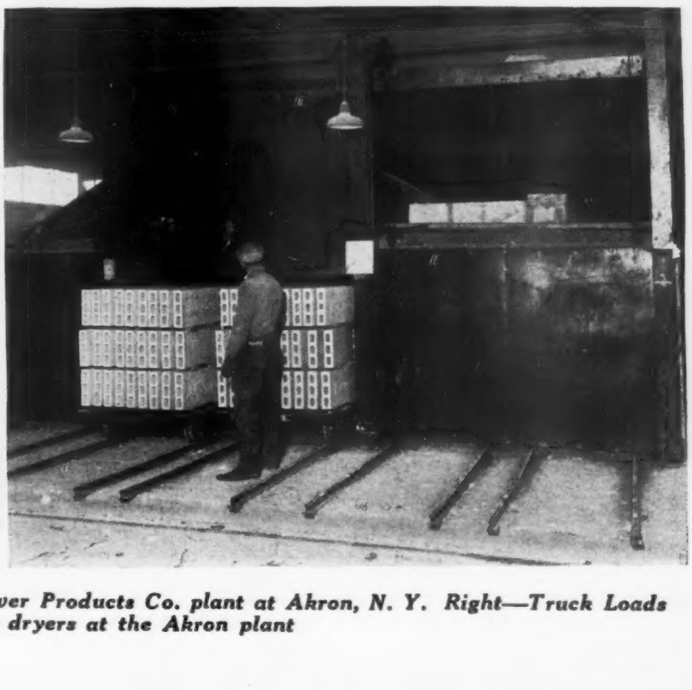
New gypsum block plant of the Beaver Products Co. at Akron, N. Y.

In the wallboard plants the tendency is toward longer machines and longer dryers—those of the National Gypsum Co. being 625 ft. and 350 ft. long, respectively. This permits speeding up manufacture from start to finish, and both board making and drying operations have become nearly automatic. The National company's machine has a capacity of 250,000 sq. ft. per 24-hr. day. Many refinements have been made in the Coe wallboard dryer and boiler operation, and this type of dryer is fast replacing the older, slower and more cumbersome tunnel type of dryer.

The progress made in the last two or three years in wallboard manufacture is fast being duplicated in block and tile manufacture, which also will soon become practically an automatically controlled machine operation. Good examples of the progress made in this field are illustrated herewith, the first being the recently completed block plant of the Beaver Products Co. at Akron, N. Y., already referred to. As we shall publish later a description of this plant, we will refer here only to a few salient features.

As the block plant had to be built some distance from the calcining plant, an elevated screw conveyor 300 ft. long connects the two. The mixer used is a one-ton Broughton machine, discharging to an agitated hopper or feeder to a 28-double-mold Her-born block machine, designed to make one revolution in about eight minutes, with an output, of course, of 56 blocks per revolution. From the block machine the green blocks are conveyed on a slat conveyor about 90 ft., where they are picked off by hand and loaded on trucks holding 54 blocks.

The trucks are pushed by hand to the entrance of the kilns or dryers, but in the kilns the cars are moved in a continuous train by compressed-air plungers, or pushers. The 125-ft. dryers are heated by oil-fired furnaces, under thermostatic control. The blocks are in the dryers an average of 14 hours, depending on their thickness



Left—Slat conveyor carrying green gypsum block at the Beaver Products Co. plant at Akron, N. Y. Right—Truck Loads of green block entering the dryers at the Akron plant

(2-in. to 6-in.). There are three dryers and their combined capacity is about 18,000 ft. per 24-hr. day. The dryers were built by the Continental Industrial Engineers, Inc., Chicago, after designs by the Beaver Products Co., engineers.

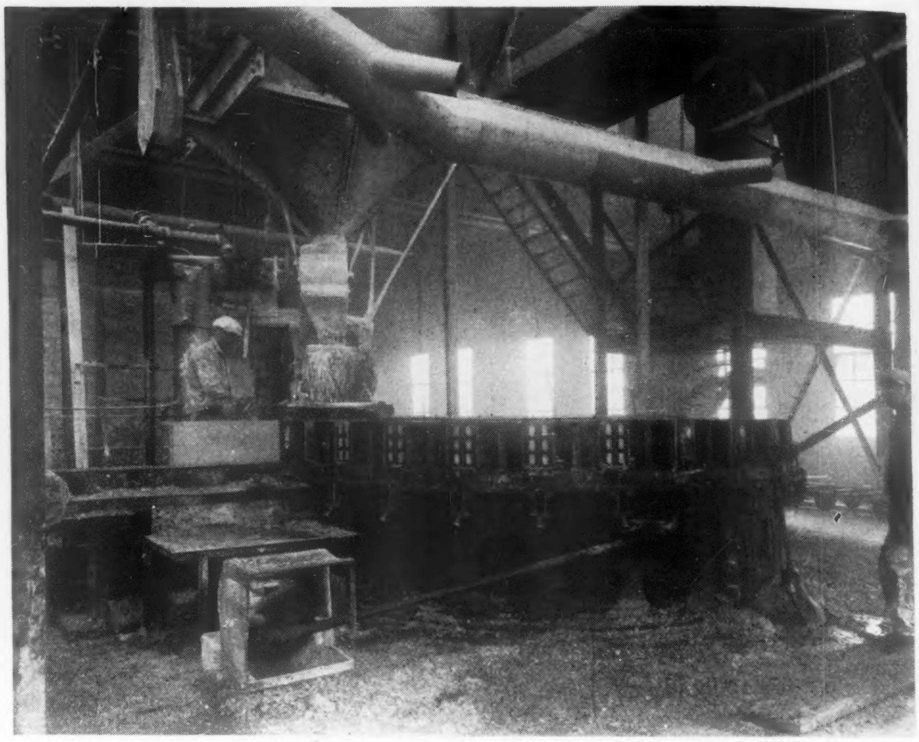
An equally interesting new block plant is that of the Universal Gypsum and Lime Co., at Fort Dodge, Iowa, which is described in detail in the article following, by J. F. Waldron, chief engineer of the company.

Engineers Contribute to Progress of Gypsum Industry

Until comparatively recently, most technical, or process, developments in the gypsum industry were made by one or two of the larger companies. Recently the attention of outside engineers has been drawn to the opportunities afforded by this industry, and they have contributed much to its progress, particularly in the drying of gypsum products, which was always "the neck of the bottle."

The past five years have seen the growth of an organization whose avowed object is to make a scientific research into the behavior of gypsum under all conditions, so as to enable them to improve the existing products made from gypsum stucco; to develop processes and machinery for reducing to a minimum the cost of manufacturing existing products, to evolve new products, which new products will make it possible for the gypsum manufacturer to obtain the highest possible per ton of stucco. This organization is the Gypsum Engineering and Manufacturing Co., Chicago, and the "Gibraltar" block machine described in the article on the Universal Gypsum and Lime Co.'s plant is its first contribution to the industry.

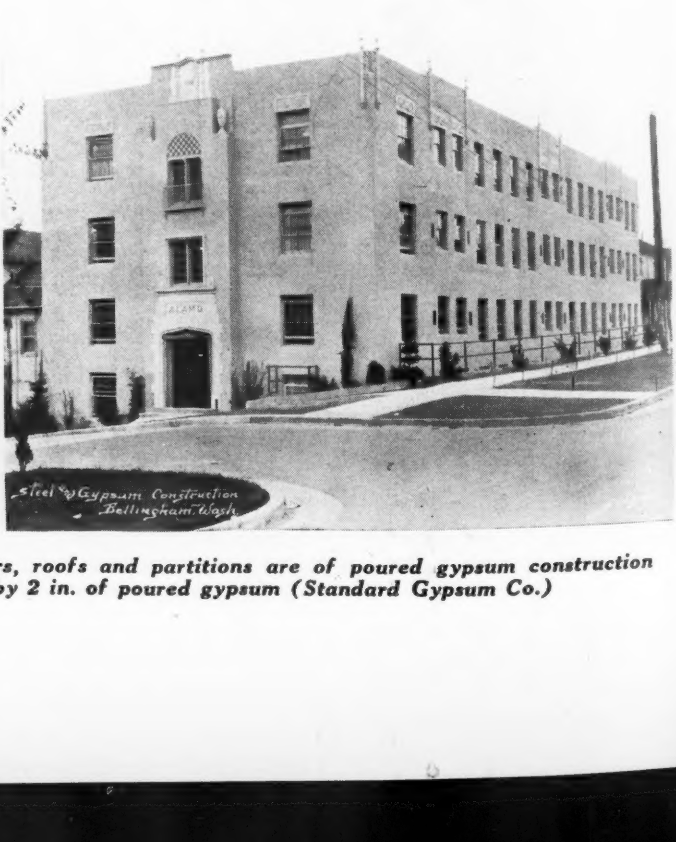
The president of this company is Robert I. Rheinstrom, an engineer and business man by education and experience; and the vice-president and chief engineer is Caleb Payne, a man who has spent practically his entire life in the gypsum industry, in England and in this country. For years he was chief engineer of the United States Gypsum Co. This firm has a laboratory in Chicago, and has also done much work in the developing and perfecting of a continuous, self-cleansing, automatic mixer, applicable to mixing stucco for the making of blocks as well as other gypsum products. Since the original block machine was installed at the plant of the American Gypsum Co., Port Clinton, Ohio, about two years ago, installations have been made at eight other plants, including the one described here.



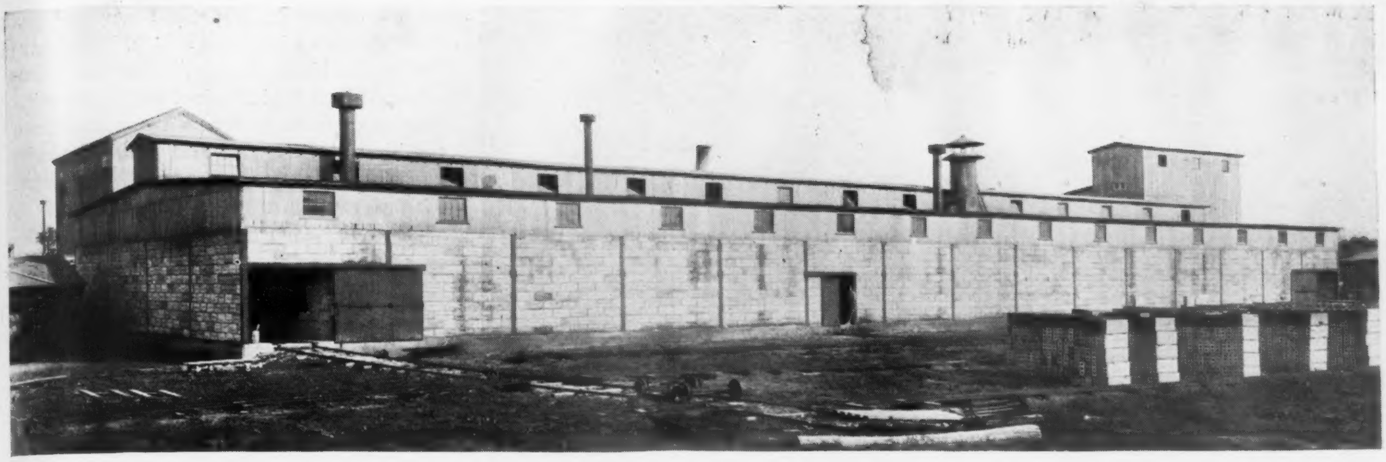
Double-mold, rotary-type gypsum block machine at the Beaver Products Co. plant at Akron, N. Y.

Industry Passing "Secret Process" Stage

We have referred to the Gypsum Engineering and Manufacturing Co. at some length because we believe that its organization and the plan it has worked out really mark an important epoch in the gypsum products industry, which heretofore has been particularly noted as a "secret-process" industry, where every attempt has been made to work out manufacturing and process problems individually and to hold them in secrecy. Consequently, the smaller producers, without an expensive research staff, were at something of a disadvantage. The industry is passing this stage and expert professional services may now be obtained by all gypsum products producers, the smallest as well as the largest.



Steel and gypsum buildings at Bellingham, Wash. The floors, roofs and partitions are of poured gypsum construction and the walls of the building at the right backed by 2 in. of poured gypsum (Standard Gypsum Co.)



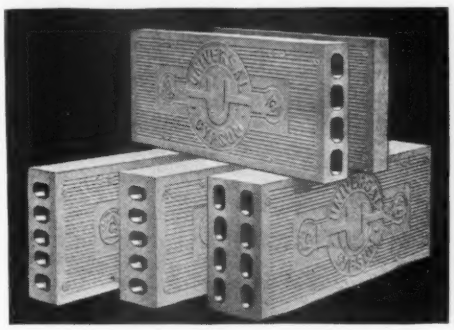
New gypsum block plant of the Universal Gypsum and Lime Co. at Ft. Dodge, Iowa. The storage yard is in the foreground

New Gypsum Tile Plant of Universal Gypsum and Lime Company

By J. F. Waldron
Chief Engineer, Universal Gypsum and Lime Co.

OWING to the expansion of the gypsum tile business in the last year, the Universal Gypsum and Lime Co. constructed a new block plant at their Ft. Dodge Plymouth mill to meet the increased demands placed on their production. In deciding to proceed with such an installation, careful consideration was given to the latest methods of molding, handling and drying the tile; therefore, plans were evolved that represented the latest type of gypsum tile production which would allow of expansion to meet future demands for gypsum tile and its allied products.

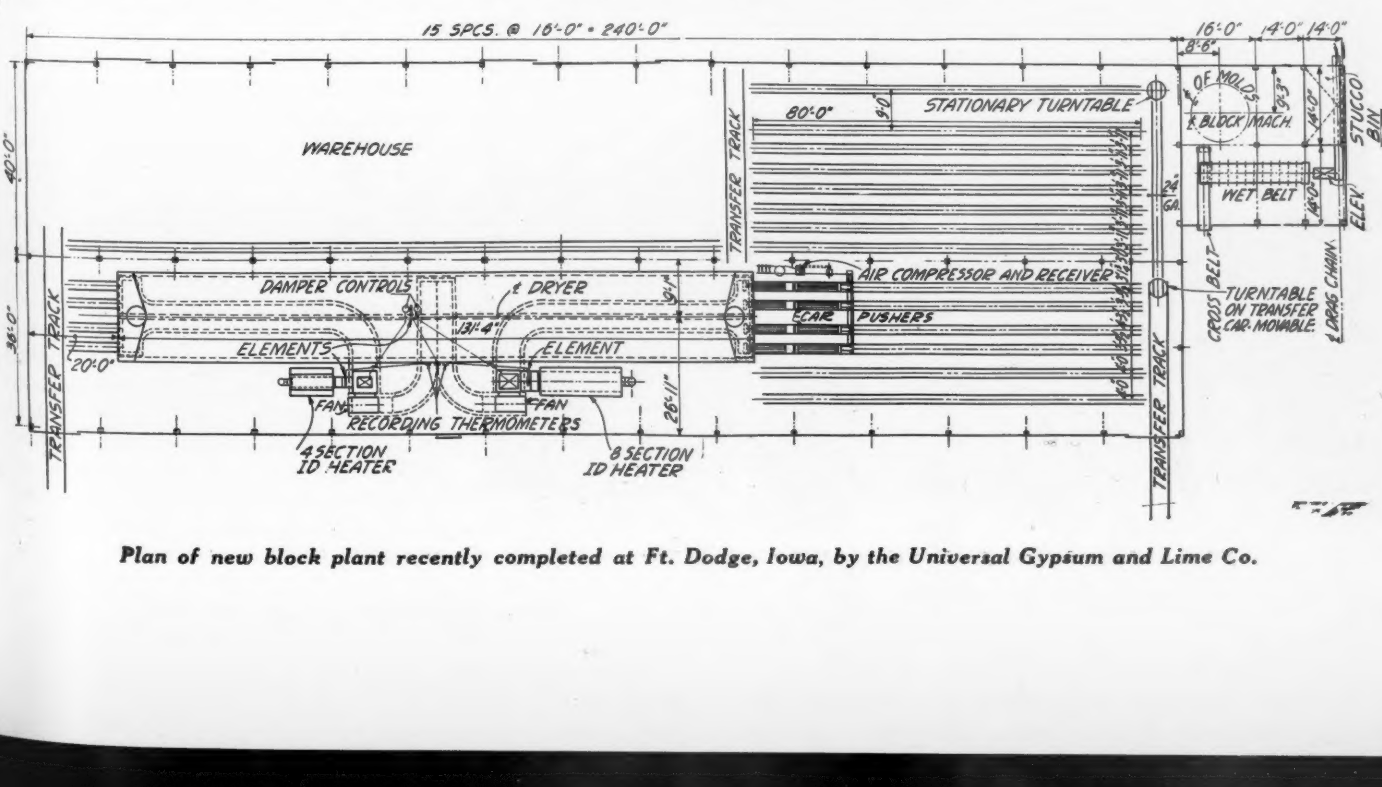
After extensive investigation and consideration, a standard type of molding machine was decided upon that represented the most modern method of molding gypsum tile; this machine was the "Gibraltar" type manufactured by the Gypsum Engineering and Manufacturing Co. of Chicago, Ill.



Types and sizes of tile made at new Universal block plant

Previous to the adoption of modern methods for the molding of the tile, the method of air drying the tile was as crude as the hand molding operation for producing block. The old method of drying made it necessary to rehandle the block many times. To eliminate the time element in the drying and also the handling, very careful consideration was given to a rapid method of drying. The method of drying must above all be economical in operation, and cause no discoloration of the blocks. A system was developed by the Drying Systems, Inc., Chicago, Ill., using oil as a fuel, that the company's engineers felt would be rapid, safe and economical.

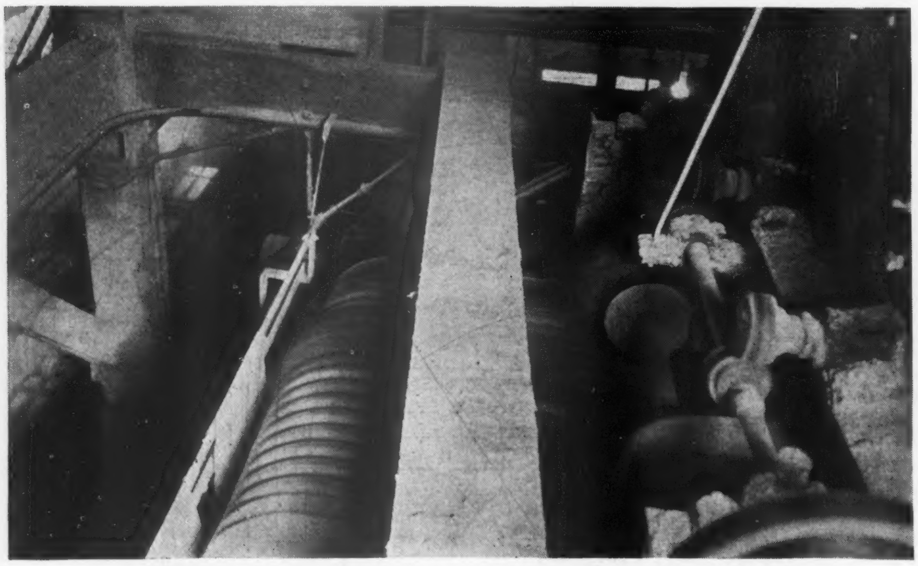
As the site of the gypsum tile plant is near the source of manufacture of the stucco,



Plan of new block plant recently completed at Ft. Dodge, Iowa, by the Universal Gypsum and Lime Co.

Soaking belt and stucco feeder. The stucco is combed on the belt by the feeder device

Hoppers for fiber and accelerator above the soak belt. The soak belt coming out of the water section appears below the hoppers



Fiber and accelerator feed at the end of the soak belt

it is conveyed by screw conveyor and belt conveyor on an overhead bridge to the stucco bin in the block plant. A drag chain conveyor, driven by individual motor through a spur gear reducer, draws the stucco from the bin and delivers it to a standard 20x48-in. centrifugal discharge bucket elevator. This elevator in turn delivers the stucco to a feeder device installed over the end of the soak belt.

Soak Belt and Accessories

The feeder device mentioned above is controlled in its rate of feed to the belt by the driving arrangement that drives and controls the speed of the soak belt. This device also combs the stucco on the belt in furrows, which allows the water in the soaking operation to thoroughly permeate the stucco.

The soaking operations are obtained by the belt, with its covering of stucco, passing through a water bath maintained at a constant level on the belt itself, the belt forming its own trough. The belt comes out of the water section and passes below the fiber and accelerator hoppers. The fiber is fed on to the soak belt by a drag belt with spikes that run through the bottom of the fiber hopper. The accelerator is deposited on the belt by a small drag chain in the bottom of the hopper. The ratio of these two materials to the amount of stucco is maintained through the same control driving rig as the one that drives the feeder device and the soak belt itself. The speed of this rig is controlled manually by the operator at the molding machine, this being necessary on account of varying speeds required at times for the molding machine. To prevent the accelerator and fiber from arching in their hoppers, driven agitators are used.

Cross Belt and Mixer

From the soak belt the stucco, together with the fiber and accelerator, is deposited on a narrow troughed rubber belt conveyor. This belt ordinarily is driven in the direction of the mixer at one end, but can, in case of necessity, such as stoppages of the molding machine, be reversed and the material dumped off the other end, where it is collected in containers, allowed to dry, then ground up and used as accelerator. The material on the cross belt is delivered to the mixer, as no agitation of the mixture takes place while on the soak belt; all mixing is done at this point. The mixer is one developed by the Gypsum Engineering Co. and is really a batch mixer, operating on a positive cycle, but the time interval is so small that its operation is practically continuous. The time interval is actually the time of advance of one mold, in direction and speed of rotation, to the next mold on the molding machine. This mixer is automatic and self-cleaning, which is a very important item—a feature sometimes claimed but not always found in batch or continuous mixers. This machine is driven and controlled separately from the soak belt and

its accessories, being always under control of the molding machine operator.

As previously stated, the control of the cross belt, soak belt, accelerator, fiber and stucco feeders, is regulated manually, as a unit, by the machine operator. This is possible due to these units being driven by one 3-hp. motor, through a No. 0 Reeves variable speed transmission, gears and chain and sprockets.

Molding Machine

As mentioned before, the "Gibraltar" molding machine is 12 ft. in diameter, 37.6 ft. in circumference, with the 20 vertical molds evenly spaced on its circumference. These molds are readily interchangeable so that molds made up of four 3-in. units, three 4-in. units, two 5-in. units, or two 6-in. units can be used, according to the required production. All tile have standard face dimensions of 12x30 in. Reinforced block for short span roof tile can also be made on this machine. Ordinarily the machine is fitted with fifteen 3-in. and five 4-in. molds. The molds are made interchangeable so that other sizes of tile and other types of precast products can be made on the same machine.

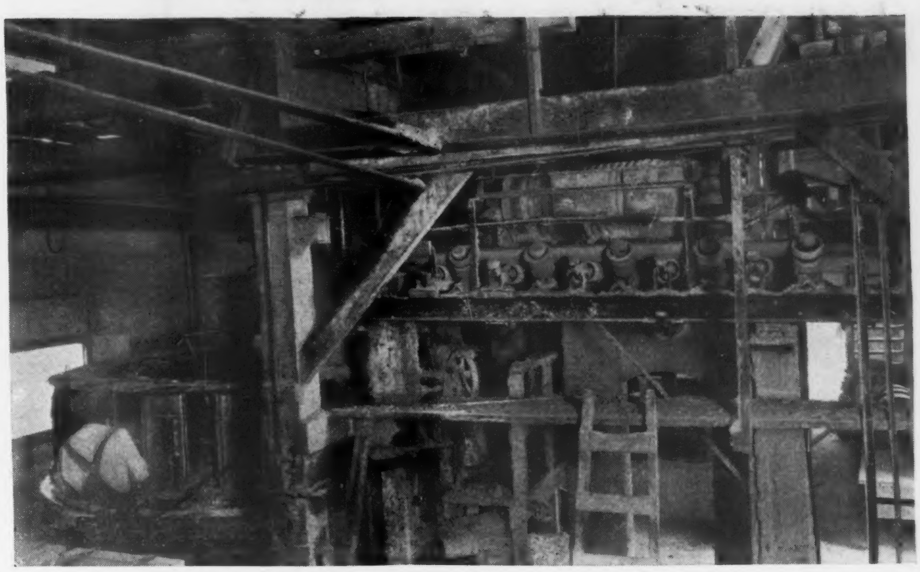
In the cycle of operations, the material is discharged from the mixer into an open mold as the machine slowly revolves. The cores are then slowly and automatically raised so that when the mold is filled the core pins are up, and as the filled mold progresses to a certain point, the core pins and division plates start to pull downward. The complete operation of pulling the pins and plates is not accomplished until the mold has traversed 50% of its circumferential travel.

The molding machine represents the best of mechanical design and is constructed from materials that are most suitable for a machine that must embody ruggedness as well as automatic mechanisms.

The operations for opening and closing the doors of the molds, spraying the molds with a lubricant, pulling of the core pins and pushing off of the blocks from the molds are entirely automatic, and are always in time with the speed of the machine. This is possible by the simple arrangement utilized in driving the entire machine through one motor, a variable speed transmission, master gears and star wheels.

The molds are made from cast aluminum, the division plates which draw down with the cores are made from half-hard brass, and the core pins are drawn from half-hard brass tubing; these materials are used to prevent rust and corrosion. The molds with their component parts are sprayed with a mixture of castor oil and kerosene to facilitate the removal of the block from the molds.

When the mold reaches a certain position it is automatically tilted toward the outside of the circle, for freeing the block from the mold. The blocks are directly loaded on to narrow gage steel frame cars. Each car, in



Cross belt at end of soak belt delivering material to the mixer. The control of materials is maintained by the worker at the molding machine

Stucco discharging from the mixer to the open molds as the block machine slowly rotates

Top view of the rotary block machine showing the drives

the case of the 3-in. block, contains 60 blocks, and in the case of the 4-in., 54 blocks.

Loading the Dryer

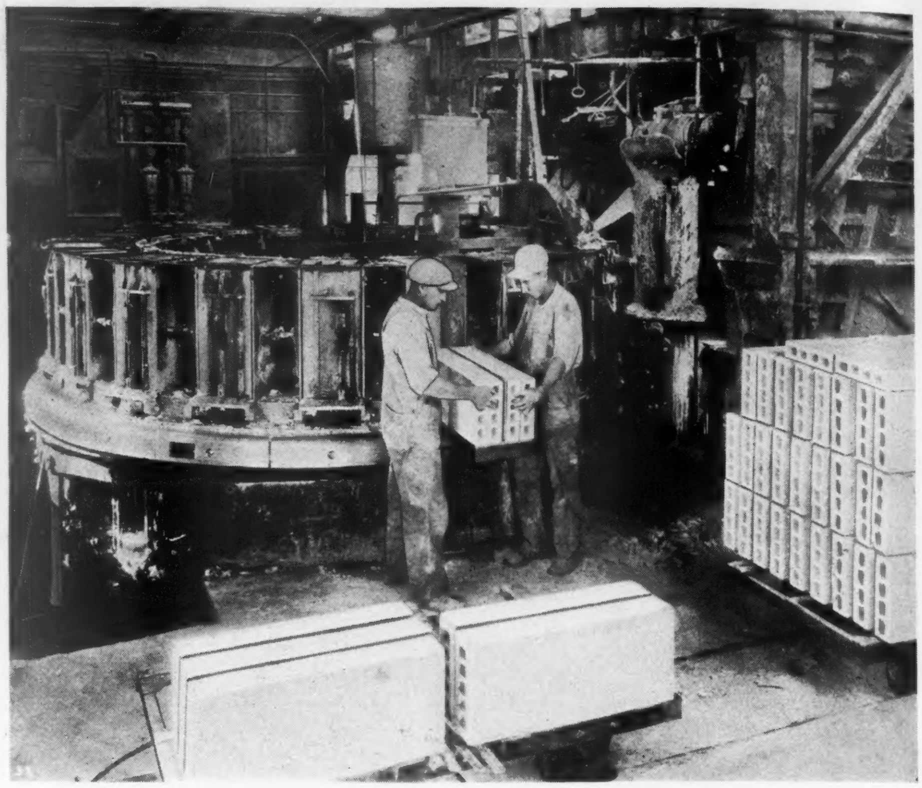
After the cars are loaded they are placed on the storage tracks in front of the tunnel kilns. When sufficient cars are loaded to fill the two tracks of each tunnel, the cars are pushed into the kiln by automatic car pushers. These pushers are of the pneumatic type and consist of an air cylinder, piston rod and dog, which engages the axle of the cars and are controlled by an operator. The cars are pushed forward the length of the piston travel, which is slightly more than the length of a car; they then on the opposite stroke return to the first position to engage another car. This is continued until the tunnel is loaded; this same feature is utilized for removing the cars with the dried block from the opposite end of the dryer. Each track has its own pusher. Raising and lowering of the doors on either end of the tunnels is also pneumatically controlled.

The Dryer

The tunnel kilns are two in number, with two tracks each. They are 131 ft. 4 in. long, 16 ft. 7 in. wide, and 6 ft. 0 in. high. Concrete ducts below the floor of the dryer serve to circulate the heated air, also to recirculate the air to the fan make-up chamber. The amount of outside air taken in through the fan is controlled by dampers which are operated thermostatically. The humid air is exhausted at each end of the dryer by large exhaust stacks extending through the roof of the building.

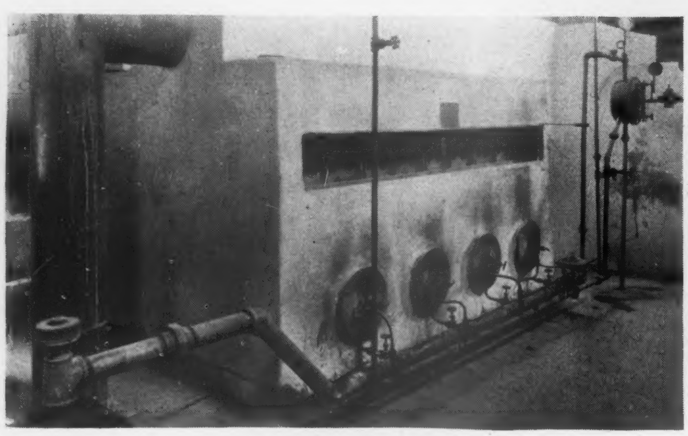
The kiln fully loaded has a capacity of 88 cars, or 12,870 ft. of block. The drying time of the blocks is approximately 16 hours, which is one 10-hour-day production of the molding machine. After the cars are removed from the kiln they are brought into the warehouse section, where they are immediately "loaded out" to freight cars adjoining the warehouse building or placed in the warehouse for storage.

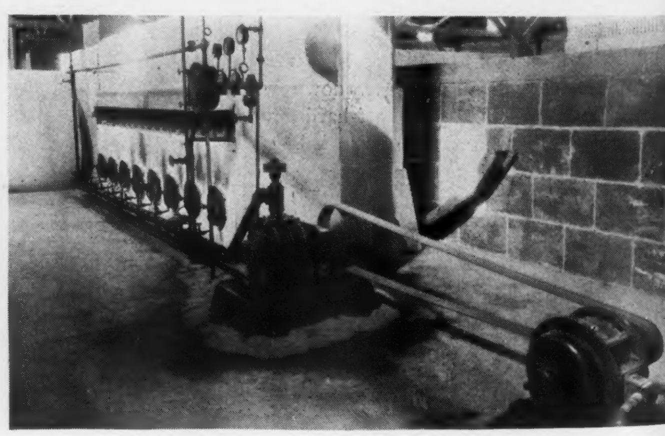
The heating equipment used to operate the dryers consists of two groups of furnaces, commonly referred to as induced draft heaters, designed and manufactured by Drying Systems, Inc., of Chicago, Ill. One group



Taking off tile from the block machine. The tile are placed on the steel cars shown at the right

Lower view of block machine showing how the cores are pulled





Four-section furnace (left) and eight-section furnace (right) supplying hot air to dry and wet ends of the dryer, respectively

of furnaces, made up of four sections, supplies air to the dry end of the dryer, and one unit, made up of eight sections, supplies air to the wet end of the dryer.

The furnaces are of fire-brick construction, with combustion chambers properly designed for liquid fuel. In this particular installation a medium heavy fuel oil is used; it is finely atomized and sprayed into the combustion space, using compressed air at a 5- or 6-lb. gage pressure. The fine mist of oil is immediately consumed, combustion being supported by the reflected heat of the refractory lining.

The products of combustion are drawn through the heater into a mixing chamber where they are thoroughly mixed with fresh air and also air recirculated from the dryer. The mixed air, which is maintained at a predetermined temperature, is then drawn through induced draft fans, one of which is supplied with each group of heaters, and discharged through underground duct work into the dryer.

It is to be noted that while the furnaces are supplied with a smokestack, this is only used during the starting period. As soon as the furnaces are warmed up, the smokestack is closed by means of a damper and all the products of combustion are used in the dryer in the manner above described.

The combustion is so complete and all carbon is so thoroughly consumed that there is no trace of soot in the gases and the heated air thus supplied to the dryers contains no more injurious dust particles than the outside atmosphere from which the air supply is drawn.

It is quite obvious that with an arrangement of this sort high economies can be effected, there being no heat thrown away through the smokestack.

Buildings

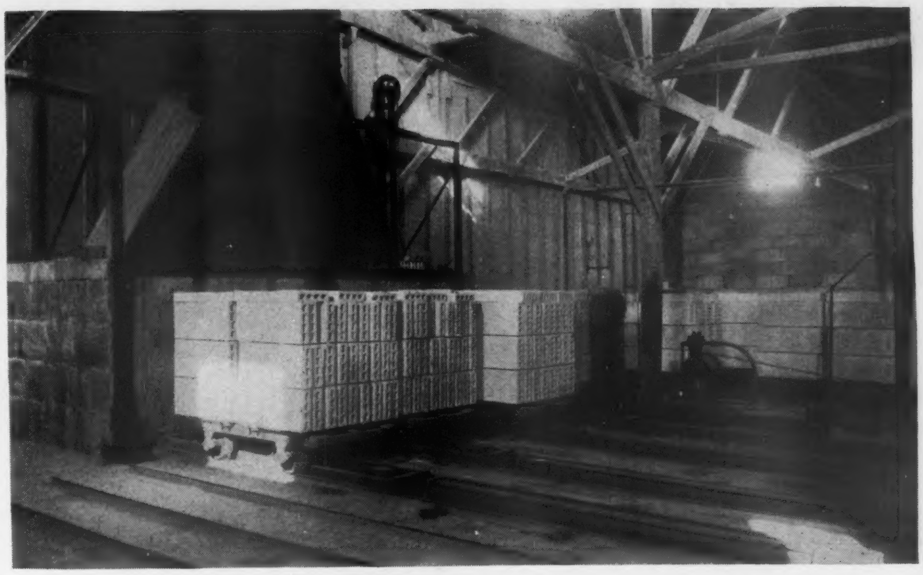
The block plant building consists of two main units, the machinery building and the dryer and warehouse building.

The machinery building is 44x32 ft., three stories high. The molding machine is on the first floor, also miscellaneous machinery; the second floor carries the soak belt and its machinery, and the third floor contains the fiber storage room and drive for stucco elevator, also the belt conveyor machinery from the stucco mill. This building is of timber frame construction with exterior walls of corrugated iron and interior walls lined with gypsum blocks.

The dryer and warehouse building is 76 ft. wide and 240 ft. long. A monitor extending full length of the building affords light and ventilation. This building is of similar construction to the machinery building, with the exterior walls below the roof truss line of 5-in. gypsum tile and above the truss line of corrugated iron. The warehouse section has a capacity of over 100,000 ft. of tile.

A band saw is installed in the warehouse building to recut the tile to definite sizes for special orders.

The complete plant has been constructed with the idea in mind of easily increasing present production 50% by the addition of a new drying unit and building alongside of the present dryer. The present machine would produce sufficient tile in 24 hours to allow this increase.



Loading tracks before the dryers; each track has a pneumatic car pusher

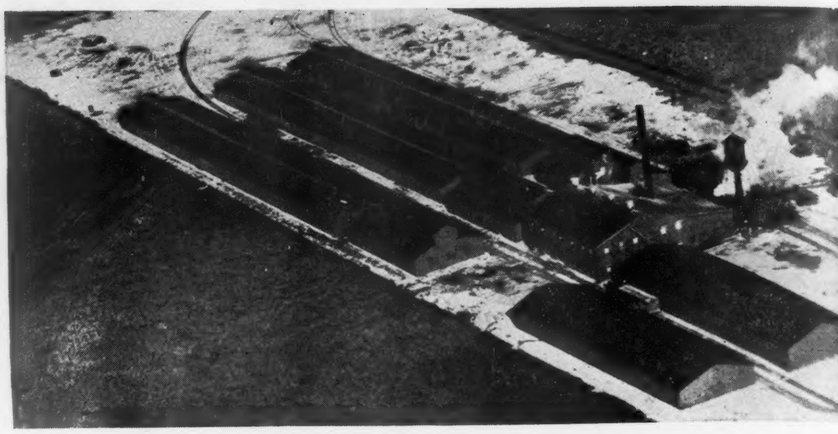
Loaded cars ready to enter the dryers

Commercial Manufacture of Gypsum Retarder

IN the manufacture of gypsum products, particularly wall plaster, it is necessary to check rapid set in order to finish. To accomplish this purpose, a small amount (less than 1%) of some material is added during the mixing. The material added is known as a "retarder" and while made in some instances by the gypsum companies at the mills, a large part of that used in the industry now comes from the plants of the National Retarder Co. This company is a pioneer in the commercial manufacture of retarder, having been established for over 30 years. The original plant at Webster City, Iowa, was in operation until this year, when the new plant erected at McCook, Ill., was put in production.

Early in 1923, A. H. Gallagher, president and guiding genius of the National Retarder Co., purchased 43 acres of undeveloped land at McCook, Ill. Before putting up the plant buildings the site was drained and a fill of 85,000 yd. of limestone screenings made. One and one-half miles of railroad siding were put in place to facilitate reception of raw materials or shipments of finished retarder on the four main railroads which service the plant.

Eleven buildings have been erected on the site, of which some are interconnected by belt conveyor or other means. All are of steel frame and galvanized siding with concrete floors. Three of these, each 400x62 ft., are used for raw material storage, a supply sufficient for one year's operation being kept as a reserve. The remainder are used for housing various equipment used in the manufacturing process. The brief description of the operations at the McCook plant which follows will be developed in a future issue of Rock Products, at which time a more complete and detailed story will be published.



Airplane view of the McCook, Ill., plant of the National Retarder Co.

The chief raw materials used in retarder manufacture are those of organic structure with a nitrogenous base, such as waste cattle or goat's hair, hoofs and horns. At the McCook plant horns and hoofs from domestic sources and Mexico, India or South America are used. These are unloaded at the plant from the railroad cars onto a pneumatic conveyor which spouts them to storage. This conveyor is of unusual design and was devised by the company's engineer. A complete description with illustrations will be published in the "Hints and Helps" department in an early issue. From the storage piles the hoofs and horns are carried by conveyor belts to a hopper which feeds a hammer mill. A magnetic pulley set over the hopper removes the tramp iron. After passing through the mill, the hoof and horns, reduced to ¼-in. size or less, drop onto a screw conveyor leading to a belt and bucket elevator which passes them to another screw conveyor from which they are discharged into storage bins.

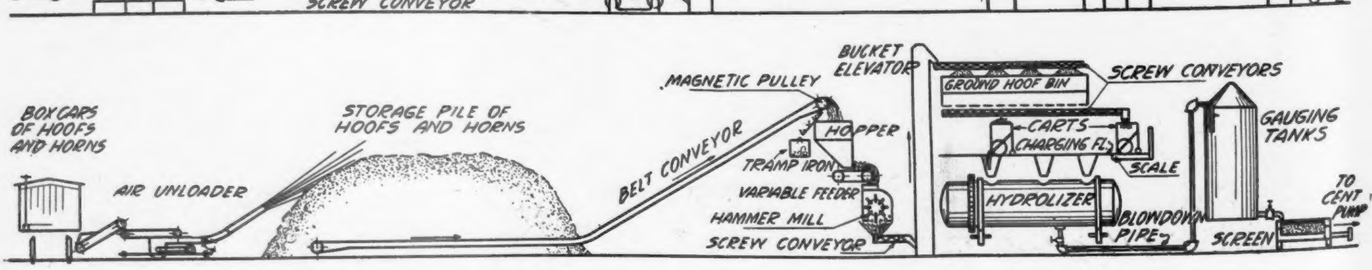
The raw ground material is drawn off from the storage bins into hopper-bottomed tared carts. After weighing, these carts are wheeled into position and the contents dumped into an opening in the charging floor which leads into the hydrolizer. This is a horizontal cylindrical steel-jacketed tank rotating on trunnions built to withstand pressure and of sufficient capacity to hold about one carload of retarder. Before adding the raw ground material, the hydrolizer is charged with caustic soda and water. After all the material has been charged, the covers on the hydrolizer are clamped into place and the apparatus set in rotation at slow speed for about two hours. A steam pressure of about 150 lb. is maintained during the entire hydrolizing process.

Careful Blending an Essential

The conversion of the hoofs and horns into "keratin" being completed, the material is blown into a condensing and gaging tank. The keratin is semi-liquid and viscous and of a yellowish-green color with a slight ammoniacal odor. In the condensing and gaging tank the keratin is given a definite consistency by heat or water, depending on the state it enters the tank. It then passes through a rotary screen which removes lumps and foreign matter, to a centrifugal pump which forces the keratin into two large blending and storage tanks. These tanks are equipped with mechanical agitators and a recirculating system by which the bottom liquor is drawn off and put back at the top of the tank, thus assuring a constant and uniform mix of the liquid keratin.

As needed the keratin is pumped from storage into a measuring tank, where it is passed to a crutcher. Here the proper proportions of lime are added and thoroughly incorporated and then the mix dropped onto a screw conveyor to a trough feeder. This is an ingenious type devised by the company to meet the unusual condition of the material. At the bottom of the trough are placed a series of ¾-in. holes about 4 in. apart. The material entering the trough is so sticky that it will not fall through these holes, so a set of plungers is used to force it through and onto the sectional belt dryer. By an automatic arrangement the plungers are so regulated that they make a down stroke at intervals, and in this way the material is spread on the plates of the dryer below. Since only a small amount is forced through each hole, the effect of small buttons, semi-spherical in shape, is produced on the dryer plates. To prevent these buttons from sticking to the plates, a blast of hot air (almost 800 deg. F.) is forced against them and causes a thin dry coating to form on the outside.

The sectional belt dryer consists of 364 plates, each 9 ft. long and 1 ft. wide, attached in the form of an endless belt. The



Flow sheet of the National Retarder Co.'s operation at McCook, Ill.

arrangement is such that each plate with its load of material passes along the length of the dryer six times before ready to be discharged at the bottom. The hottest temperature, about 800 deg. F., is at the top, and diminishes gradually so that the temperature of the outgoing air is about 225 deg. F. The dryer is entirely enclosed and well insulated to reduce heat losses to a minimum. About 90% of the moisture in the material is removed in this way.

After the plates have completed the circuit in the dryer, automatic scrapers remove the dried buttons which fall through a hopper onto a screw conveyor feeding a small mill where they are crushed to ¼ in. and thence pass to a Louisville dryer, where the remaining moisture is removed. The completely dried retarder then is carried by bucket elevator and screw conveyors to any or all of the eight storage bins, each of 20-ton capacity. The retarder is drawn off the bottom of these bins and brought to the finish mill, where it is ground to pass 95% through 350 mesh. An air separator takes out the part that is sufficiently fine and the rejects are returned to the mill for further grinding. The finished retarder is gathered in a collector and carried to storage or a Bates bagging machine, as desired. The material is packed in 100-lb. sacks and piled in the warehouse or shipped. The present capacity of the plant is about 40 tons per day, but this will be increased within a short time.

The president of the National Retarder Co. is A. H. Gallagher, and L. H. Steward is chief engineer and superintendent. Offices are maintained at 130 North Wells St., Chicago, Ill.

Slate Demand Increases in 1926

THE slate industry, which in 1925 appeared to be just about holding its own, in the past year recorded a good advance in production and sales. The following from W. A. Kitto, general manager of the Structural Slate Co., Pen Argyl, Penn., bears out the optimistic reports received from various sources during the year. He says:

"As compared with 1925, this year's production and sales of structural slate have been averaging 20% in excess, with the largest gains in September, October and November. The increase is almost uniform on all lines included under the heading 'Structural Slate,' viz.: Toilet enclosures, wainscoting, treads and platforms, electrical, grave vaults and mausoleum slate.

Prompt Deliveries Great Factor

"The factors principally responsible for the increase were added facilities for production, assuring prompter deliveries, and the product manufactured by the Structural Slate Co., Pen Argyl, Penn., sold under the trade name of 'Struco Slate.' With its use, architects and engineers can utilize the qualities possessed by slate and at the same time obtain the desired decorative or harmonizing effects. New uses made of slate are oil compartments in power stations and exteriors for receiving vaults.

"The total shipments have been in excess of 2,500,000 sq. ft. of structural slate with 85% of the consumption east of the Mississippi. Considerably more slate is being used in the south with the tendency toward fireproof construction. Shipments into the Philadelphia territory have been much larger than the year before, there being used in the exhibition buildings of the sesqui-centennial approximately 75,000 sq. ft., principally for toilet enclosures and walks. Approximately 500,000 sq. ft. of slate was used for grave vaults and mausoleums, most of the grave vaults being used at a distance of not more than 250 miles from the slate regions.

"Possibly the most extensive use made of milled slate is for blackboard purposes in school rooms. The market, because of its limitation to educational buildings, is variable, depending on the extent of the school building program of the nation. Fewer schools were built or completed this year than in 1925, with the result that the blackboard production and sales declined about 30%. The falling off was quite evident in New York City, where they opened only two new schools in September, 1926, as compared with 34 in September, 1925. The New England States, Minnesota, the Dakotas and the Pacific coast built fewer schools, while Washington, D. C., and Chicago built more during the present year."

Increased Use of Labor-Saving

A further analysis of the factors leading to increased production brings out the interesting facts that it is largely due to changes made in the slate mills. New machinery of the latest labor-saving design have been added to many plants in the Pen Argyl district and several new mills recently built are equipped for efficient and economical production of roofing slate. The newer methods of manufacturing based on developments and research work of the Bureau of Mines have been adopted with the result that the slate industry is on a better basis than ever. A complete report of the Bureau of Mines work on slate called "Recent Progress in Slate Technology" was published in ROCK PRODUCTS, October 16 issue, and by reference to this a better understanding of the great progress made in the slate industry can be obtained.

There were few new slate companies during the past year, our records showing only six with a total capitalization of $968,000. Two of these companies, the Southern Slate and Marble Co. and the Tennessee Slate Products Co., are to develop quarries in Blount county and Marion county, respectively. The Tennessee Slate Products Co. will also make slate granules and cement brick with slate granule facings besides the regular roofing slate. Other projects include the Searles Slate Co., Inc., New York, and the Brownsville Slate Corp., Portland, Ore. Detailed information on the plans of these companies is lacking so it is hard to say whether they have passed the promotional stage. In addition to the improvements made at different plants there have been no less than seven new mills built in the Pen Argyl, Penn., district. These were all erected by producers already established in the locality. In California the recently organized El Dorado County Slate Products Co. have started operations at their quarry near Placerville.

Slate Association Promotes Activity

Too much credit cannot be given the National Slate Association for its constructive work in the past five years. Realizing that competitive materials were taking away a market that had belonged for years and should belong to the slate industry, the association started a long battle to bring back structural slate into its own. Close co-operation between producers was brought about and much money and effort expended on research to develop new uses for slate and incidentally an intensive advertising campaign calculated to further use of roofing slate was carried on with successful results. N. M. Male and W. S. Hays, president and secretary, respectively, of the association, were the prime leaders in the promotion of slate.

There were interesting meetings held throughout the year and from the present outlook the annnual conference to be held January 18 and 19 at the Hotel Commodore, New York City, will be one of the largest and best gatherings in the industry's history. Representatives from all branches of the industry, the quarry end and slate setters and roofers, are expected to attend.

Since the organization of the association in 1922, these annual get-togethers have been a great feature and have accomplished much in enthusing and stimulating the entire trade to greater effort. Some of the results of the work done by the association are shown by the fact that during the five years of its existence the value of slate sales has almost doubled. Educational and missionary work, publicity and advertising by the association have brought slate before the public in a way they can understand has enlightened architects and builders to the many possibilities of using this stone in its manifold and diversified uses in building construction.

Progress is being made toward better relations between producers and the distributors and the trade. Avoidable losses or disputes are being ironed out by a better code of business practices. And the idea is gradually being recognized that by all working together for the general good of the entire industry greater individual profits will be returned to each individual than if all worked separately.

Rock Phosphate Industry Has Average Year

By. James A. Barr
International Agricultural Association, Mt. Pleasant, Tenn.

THE general average conditions did not change greatly from those of last year, as was also the case with the tonnages mined and shipped. The floods in the north and the continued wet weather and late spring in all parts put an unexpected check to otherwise promising shipments of fertilizer thus affecting rock phosphate.

Undue stress has been placed upon the low price of cotton, since the total money return for the crop is the main consideration. The amount of cash going into the South this year for its cotton should not vary alarmingly from the average. The increased use of fertilizer to cut cotton production costs may aid the phosphate industry.

The long-drawn-out British coal strike has seriously held back phosphate exports. The large increase in coal shipments took up all the available ocean bottoms at much higher freight rates than the phosphate could stand. The recent settlement of the coal strike will soon start correcting this situation.

Competition from Morocco and other African sources continues very keen but the recent rising tendency of the franc automatically increased the relative cost of African production. The producers of this country by their continued improvements in processes, production methods and other possible economies will continue to hold their own.

New Processes

In the mining fields no particular new improvements have been made except as general operating experience and the use of more efficient labor has permitted larger outputs for a given unit.

In the processing and manufacturing of phosphates there have been no outstanding betterments. Mechanical handling devices and better working conditions are more in evidence; less common labor is used, being supplanted by fewer skilled operators.

The Bureau of Soils continues its well-directed efforts to perfect a method of recovery of phosphoric acid by volitilization methods direct from mine-run material. Two companies have spent considerable time and money along similar lines but no commercial results have been indicated and their activities have somewhat abated. One company in the Mt. Pleasant field reports favorable experimental results with a small furnace and continues very active with their research work. The ultimate goal of all these endeavors is to take the phosphate matrix direct from the mine, eliminate the serious losses and cost of the present preparation methods, and make a concentrated phosphoric acid, to be used as a base for fertilizer mixtures.

Florida

Since the collapse of the real estate boom the efficiency and supply of labor has been much better and operating conditions as a whole have improved accordingly. The recent storm did some damage but in the main it was not serious and the effects were soon removed.

In the removal of overburden, both draglines and hydraulic methods are used, with the majority of the companies still using the latter. The d.c. Ward-Leonard control electric dragline finds the greatest favor with the operators. Some of the largest machines have been successfully mounted on caterpillars.

All of the mining is done by hydraulic methods as the handling by water through the pumps and pipe lines is an important part of the washing operation, in addition to general operating convenience.

The use of large capacity 12-in. centrifugal pumps is now almost universal. The 12-in. pumps have approximately 50% greater head and volume capacity than the old type 10-in. pumps.

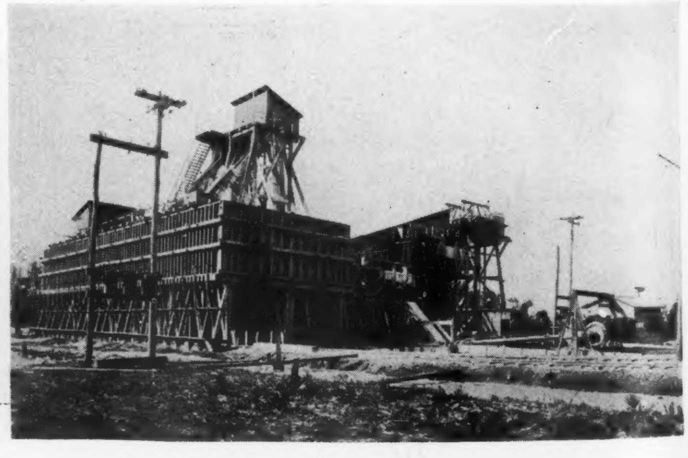
Mining and stripping carried on simultaneously. Demarcation line between the phosphate rock and the overburden shows clearly

No changes have been made in washer flow sheets, the usual line-up being rotary mud ball screens, log washers for disintegration followed by electrically vibrated screens for removal of free silica and elutriated clay. No methods have been devised for the recovery of fine phosphates lost with the undersize or the saving of soft or colloidal phosphate lost with the clay.

The majority of the new washers being erected are of steel. Timber costs have so increased and quality timber is now so scarce that there is very little difference in first cost between the timber and steel types, with maintenance costs and salvage very much in favor of the latter.

There has been very little change in drying methods or equipment. Some experimenting was done by one company with me-

Hand mining for brown phosphate in Tennessee



Florida phosphate washer of the more modern type

chanical oil burners, but increased refractory trouble overcame the increased efficiency of the burner. Generally speaking, the dryers used, 48 in. in diameter and 32 ft. long, are too small for the duty and for good efficiency at high capacities.

The rising tendency in fuel oil prices has caused the operators to investigate powdered coal for fuel, especially for the dryers. One installation was made and after the usual preliminary adjustments and changes gave good results and fuel costs lower than with oil. Any further increase in fuel oil prices will undoubtedly see many changes from oil burners to powdered coal burners.

The "hard rock" district continues practically inactive, owing to high cost of operating and spotty deposits.

Tennessee

There has been very little change during the year, no new construction or enterprises.

In the open pit mining operations of the brown rock field, practically all of the overburden is now removed by steam draglines, which are also used to mine part of the phosphate. Hand-mining methods are still used to mine the phosphate occurring in narrow crevices in the limestone, locally called "cutters," and will continue to be used until labor is much scarcer than it is now.

There is only one undeground mine in operation to any extent, in the "blue rock" district. Here the room and pillar system is used and the phosphate strata removed looks very much like blue limestone resting on a lime floor and overlaid by a parting and a shale roof.

In the washing and preparation of the brown phosphates, the main requirement is a thorough elutriation of the clay by some mixer such as a log washer, and the subsequent separation of the clayey water by screening and classification. The screening is used to separate the lump so that the balance of the sizes can be properly handled in the various types of classifiers.

The present methods of washing and concentration do not remove the silica grains from the smaller sizes. The phosphate and the silica being very close to one another in specific gravity precludes the use of gravity or water construction. They cannot be separated by screening.

Considerable research work is being conducted, investigating the improvement in concentration methods and improvement in grades of the finer sizes of phosphates but as yet no commercial results are obtained.

The direct heat drying of phosphate continues along the same lines using hand-fired coal furnaces. In general the efficiencies of the dryers are very good and on an average better results are obtained than in the Florida field. This is due in part to using a larger dryer, of proper size for the capacity. Very often the Florida phosphate pebble is porous and the entrained moisture is difficult to drive off, or evaporate.

In the west the main activities have been confined to one company which converts all the rock into 50 deg. phosphoric acid or 42% to 48% (P_2O_5) triple-superphosphate. Since most of the shipments are to the west coast and the eastern central states, this concentrating is made to save freight charges. By-product sulphuric acid is used in making the phosphoric rock soluble for the ensuing process of counter-current decantation and filtration followed by evaporation.

Legislation

The Muscle Shoals bill is still marking time. Only part of the power is being used through the Alabama Power Company. As to the nitrate plant, it seems to be the consensus of qualified opinion, that it is obsolete. The Haber process as now modified produces nitrates cheaper and with very little power. Cheaper and more plentiful power for domestic and industrial use is the main need of the South.

Ohio Sand and Gravel Producers Hold Annual Meeting

THE Ohio Sand and Gravel Association held its annual meeting at the Neil House in Columbus on Thursday, December 2. Nineteen producers and friends sat down to luncheon and stayed through the session which followed.

Earl Zimmerman

Earl Zimmerman, Ohio Gravel Ballast Co., president of the association, reported what the association had done in the past year, and Guy C. Baker of the Greenville Gravel Co. read his report as executive secretary, to which he added the program of proposed activities for 1927. The financial condition was reported by the treasurer, Stephen Stepanian of the Arrow Sand and Gravel Co., who is treasurer of the organization.

Mr. Baker spoke briefly of the loss which the association had suffered by the death of two of its prominent members, Edward Donnelly, vice president of the Ohio Gravel Ballast Co., and Harry E. Stafford of the Concrete Materials Co. A committee was appointed to prepare suitable resolutions of sympathy to be sent to the bereaved families of Mr. Donnelly and Mr. Stafford.

All officers were re-elected and the members took the occasion to thank the officers for their faithful and unselfish work in behalf of the association during the year. The officers are: Earl Zimmerman, president; F. C. Fuller, vice president; Stephen Stepanian, treasurer, and Guy C. Baker, executive secretary.

Fred E. Hall, chairman of the national committee spoke of the coming convention and urged all Ohio producers to be present and also to bring their plant superintendents. The exhibit of machinery and equipment was described by him and by V. P. Ahearn, executive secretary of the National Association, and was shown to be an excellent opportunity to acquaint operating men with the latest developments on the mechanical side of the industry.

Those present were.

J. T. Adams, The Concrete Material Co., Columbus, Ohio.
C. M. Ault, Barnes Sand and Gravel Co., Piketon, Ohio.
Guy C. Baker, Greenville Gravel Corp., Greenville, Ohio.
C. B. Bebout, The Muskingum River Gravel Co., Zanesville, Ohio.
Fred W. Cornuelle, The Red Bank Gravel Co., Cincinnati, Ohio.
F. R. Douce, Greenville Gravel Corp., Columbus, Ohio.
I. N. Dugan, Cincinnati, Ohio.
F. C. Fuller, Portsmouth Sand and Gravel Co., Portsmouth, Ohio.
R. A. Goodwin, *Cement, Mill and Quarry*, Chicago, Ill.
F. E. Hall, The Ohio River Sand and Gravel Co., T. J. Hall Co., Cincinnati, Ohio.
Clifton Hoolihan, The Keystone Gravel Co., Dayton, Ohio.
Henry P. Lange, Queen City Crushed Stone and Sand Co., Cincinnati, Ohio.
H. H. Schaefer, River Sand Co., Steubenville, Ohio.
S. Stepanian, The Arrow Sand and Gravel Co., Columbus, Ohio.
E. B. Suiter, Suiter Material and Transport Co., Manchester, Ohio.
Earl Zimmerman, Ohio Gravel Ballast Co., Cincinnati, Ohio.
V. P. Ahearn, National Sand & Gravel Association, Washington, D. C.

Lime Products Company Now in Operation

THE Lime Products Co., White Cliffs, Ark., which recently acquired the properties and plants of the Kuppendorf-Tuttle White Cliffs Products Corp., has completed the many changes required in redesigning the plant and is now in operation. The company is producing crushed stone and agricultural limestone. H. C. Shields was in charge of construction during the changes and is now acting as manager and engineer. Mr. Shields has had a wide experience in the rock products industry and has been connected in the past with various cement companies and engineering concerns throughout the United States.

Silica Sand Industry in 1926

THAT portion of the rock products industry comprising glass sand, silica refractory sand and special blast sands and filter sands, appears to have had only an average year. In the eastern fields production and price appear to have been practically unchanged except for some lowering of price in certain localities. In the central states heavy increases in tonnages were reported along with much decreased prices. About the same condition exists in the southwestern fields, as near as could be judged from the reports received.

The net result is that glass sand prices show a small drop, taking the United States as a whole. Furnace, foundry and core sands held to practically the same price throughout the year, and blast sands and other special sands were also firm in price.

New Jersey's production of glass and other silica sands is largely for local use. Two reports received from there said that output and price were practically the same as in 1925. From that part of the Pennsylvania field in which there is a large production of glass sand of the best quality, one producer reported a fall in prices, others reported no change. No change was noted in prices quoted from the Maryland-West Virginia field.

Illinois producers without exception reported increased products and also reported a fall in price. Some of the price declines reported were as much as 15%, which would lead one to suspect that producers were bidding for business and getting it. Conditions were reported as "only fair" and "poor," but prospects were said to be better by almost everyone. One producer said that the principal obstacle to selling was the unwillingness of buyers to place orders far enough ahead so that satisfactory deliveries could be made. Another, who reported a decrease in tonnage but not so low a price as others, said that cut-throat competition had to be met if sales were to be made.

Ohio produces a great deal of silica sand for furnace linings and similar refractory purposes and producers reported increases in production and no change in price. Prospects were said to depend on the condition of the steel industry which was thought to be good.

Missouri production appears to have increased, although full reports were not received from this field. One producer whose product is sold in competition with sand from Illinois said that sand from Illinois was sold at too low a price. His output, however, showed a very substantial increase.

From the southwest it was reported that there was an overproduction that tended to lower prices. No reports of output were received from the far west and Pacific Coast, but it is noted that price reports received from this part of the country were unchanged throughout the year.

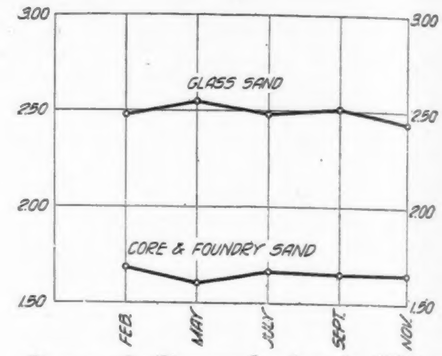
New Plants and Improvements

Canada Glass Products, Hull, Quebec, installed pulverizing equipment at Wrightville Hill, Quebec, in the early part of the year. It was recently reported that the plant is in operation and is producing about 300 tons per day.

The Maryland Quartz Co. of Baltimore took over the mills formerly operated by Nathan P. Pitcher and made a good many improvements and additions. Crushed and ground flint and quartz is being manufactured and all sizes of bitstone. The new company is headed by Michael Miller and M. M. Goldman and the name of the company is the same as that under which Mr. Pitcher, now deceased, operated.

The National Silica Sand Co., Mineral Ridge, Ohio, was formed to take over the National Sand and Stone Co. of Niles, Ohio, and is continuing the operation of the plant which was built in 1901. It is possible that the company may begin the building of a new plant in the spring. The new company was formed by William Banfield and associates. H. F. Banfield is president; William Banfield, vice president, and O. L. Cline is secretary-treasurer.

It was reported that a glass plant was to be built in Florida, but no decision to build has yet been made public. The Lake Wier Silica Products Corp., Ocala, has a large deposit of very high grade sand, containing only unweighable traces of iron, which would be available for glass making. At present this company produces sand for building and miscellaneous uses.

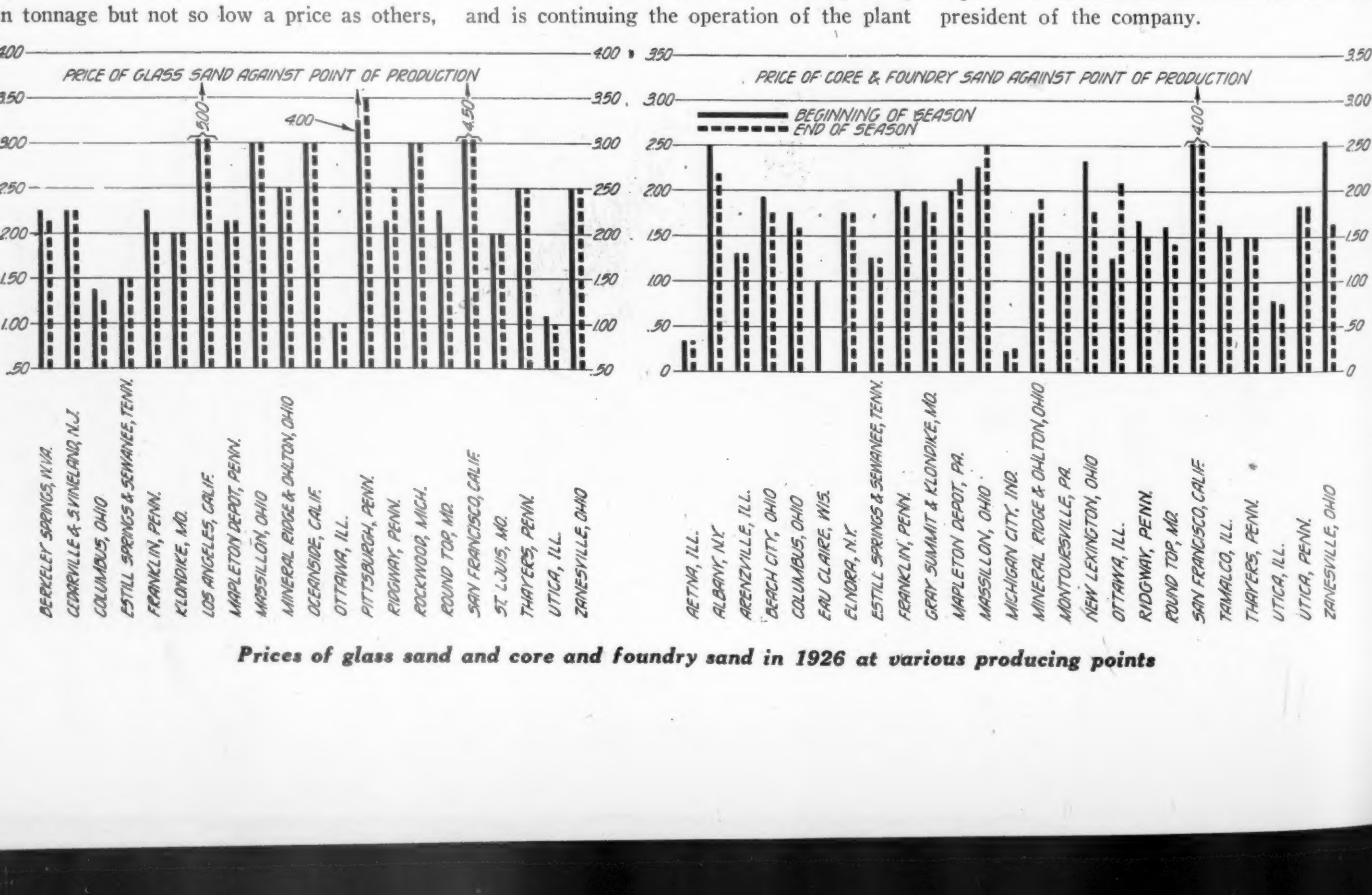


Course of silica sand prices in 1926

The Buffalo Rock Silica Co., Ottawa, Ill., began operations in the spring of 1926. The company is headed by Carl Gottfried of Chicago and Peter Vanrigt, formerly manager of the Crescent Silica Co., is general manager.

It was recently reported that a 100-ton silica sand plant is to be built at Las Vegas, Nevada, by the Nevada-Pacific Minerals Co. This company has taken over the molding sand production of the Mineral Supply Co. at Riverside, Calif.

The Gem Stone Silica Co. was organized in November at Oroville, Wash., to crush and prepare silica and it was reported that a plant would soon be built. C. W. Smith is president of the company.



Prices of glass sand and core and foundry sand in 1926 at various producing points

Magnesite, Rock Asphalt and Miscellaneous Rock Products

AS magnesite is one of the few rock products that meets with strong foreign competition the tariff situation is important. The present duty is $12.50 per ton on caustic magnesite and $6.25 on crude, and an increase has been asked for by producers who have practically lost the market in the eastern states to foreign producers. The tariff commission which has been investigating the situation finished ts work n December and the report is being prepared.

The Northwest Magnesite Co.'s plant at Chewelah, Wash., which is perhaps the largest on the Pacific Coast, is reported to be running on a two-kiln basis at present which would indicate that the production was not decreasing.

The plant of the National Magnesia Co. at Redwood City, Calif., has just been completed and had its initial run in the first part of December. It will produce 100 tons daily of crude "Dia-Sil" and a similar amount of powdered Dia-Sil (the company's trade name for its product.) The calcining plant has two kilns 80 ft. long and 8 ft. in diameter and the kilns are followed by milling and air separation equipment and a packing plant. Approximately 40 tons per day is calcined. A molded calcined brick for insulation is also produced.

It was reported that a magnesite deposit in Tulare county, Calif., was to be opened by Edward Duryee, but the report was not confirmed.

Magnesite Products Corp., Baltimore, Md., has been recently reported to have succeeded Le Compte & Co., and to have made improvements so that the output of stucco and flooring will be 300 tons per day.

Rock Asphalt

The Atlas Ken-Rock Co. of Russelville, Ky., was organized during the summer to take over the old Mason mines and other rock asphalt properties near Russelville. The financing of the company has been completed and operations are to begin in the spring with a plant near the city, connected to the quarry by a narrow-gage railroad. All the deposits to be worked are within five miles of the plant. Peter B. Young, formerly of St. Joseph, Mo., is at the head of the company.

Asbestos

The Asbestos Slate, Shingle and Roofing Co., which operates a large plant at Ambler, Penn., is building a new plant north of St. Louis, Mo., on the C. B. & Q. railroad. At the present time the foundation work has been completed and steel is being erected. It is expected to have the factory in operation some time in March.

The company is also enlarging its plant at Ambler, Penn.

Fluorspar

The fluorspar industry is reported to have enjoyed a fairly good year in spite of foreign competition. One new operation was recently reported, that of the Federal Fluorspar Co. of Louisville, Ky. This company is said to have purchased a deposit of fluorspar covering more than 200 acres which is situated near Mexico, Mo. Boilers, air compressors and grinding machinery are to be installed.

Graphite

The production of graphite from Alabama operations grew to important proportions during the war but ceased altogether as soon as the war was over and foreign importations began to come in. Recently two plants in Alabama began producing after a shut-down of seven years. They are Superior Flake Graphite Co. of Clay county and the Ceylon Graphite Co. of Clay county. Continued production will depend partly upon the tariff situation although not entirely so. The demand for graphite was lessened for a number of years owing to the oversupply that was produced and imported during and after the war.

Zonolite

"Zonolite" is a new rock product. It is an extremely light-weight material with a beautiful golden color made by heating the mineral, vermiculite, a hydrated silicate related to the chlorites and resembling mica in the crude form. The Zonolite Co., of Libby, Montana, is now preparing to produce it on a scale of 100 tons in 24 hrs. The plant just built has a rotary kiln and screens and grinding equipment. The material is used for insulating purposes as well as for an aggregate in plaster. Zonolite plaster is said to weigh only one-third as much as sand-lime plaster.

Miscellaneous

A plant to work diatomaceous earth at Eustis, Fla., was reported to be built by the Florida Diatomaceous Earth Syndicate which is operating at Clermont, Fla.

More Diatomaceous Earth Deposits Uncovered at Florida

ANOTHER large deposit of diatomaceous earth is reported to have been discovered near Augusta, Ga. The new beds were found by N. L. Willet, industrial and agricultural agent of the Charleston and Western Carolina Railway. All the deposits are said to lie directly along this railway line and cover quite a large area, one of them being 1000 acres. The depth of the beds range from 8 to 10 ft. Tests are said to indicate that the diatomaceous earth is of good quality and equal to that produced at Eustis, Fla., which is recognized as standard in this country.—*Manufacturers Record.*

Baukite New Refractory Mineral Found in Southern States

BAUKITE is a non-spalling refractory which forms an impenetrable glaze. This mineral, only known to metallurgy for the past five years, was originally mined in the Austrian Tyrol, where it was first produced at the little town of Bauchite. It is as yet almost unknown among the geologists of America, and many people confuse the name with bauxite.

A little limited deposit of the same material, varying by less than 1% in analysis, was located in eastern Tennessee, and about a year ago a still larger deposit was developed in Winston county, Mississippi.

The best known silica refractories fuse at about cone 31, while baukite fuses at from cone 32 to cone 33. When heat is applied to baukite a glaze immediately forms on the surface, which is thereafter impenetrable. It is to this peculiar glazing action that its remarkable qualities are due.

Other tests have been made to segregate the titaniferous oxides, to which components, it is believed, baukite owes its rare qualities. These are found to be zircon, rutile and limenite, with cyanite. The specific gravity of baukite is about 2.3.

The lining of a brass furnace lined with No. 1 refractory brick lasted eight heats, and when lined with baukite lasted 19 heats. It is now being used by one railroad for patching tunnel lining, and as its value is realized it is declared that it will become the greatest refractory known for high-temperature work.

Baukite is also used for saggers, for lining lime kilns and soaking pits, for fire brick and wherever a refractory is required for extreme service.—*Manufacturers Record.*

Lime Rock Association Opens Offices in Tampa

ACCORDING to a report in the Tampa (Fla.) *Times*, the Florida Lime Rock Association opened offices recently in the First National Bank building, that city, with John K. McCabe as manager.

Steadily increasing demand for the association's products made it necessary, it is said, to establish a branch at Tampa to handle the business in that section.

The Florida Lime Rock Association is an "all-Florida" organization, and its activities comprise the second largest industry in the state, it is stated.

Sand-Lime Brick Industry Has Its Best Year

THE inclement weather during the early months of 1926 and the unseasonable rains in August and September undoubtedly were factors in checking what would have been a year of greatly increased production in the sand-lime brick industry. Despite these handicaps, which slackened building and decreased the demand for brick, returns from sand-lime brick producers indicate that there was an increase of about 20% over the previous year. This estimate is based on direct returns from 17 manufacturers whose total production in 1926 was about 193,772,000 brick. Although there are about 43 sand lime brick plants in the country, the 17 producers reporting include most of the largest manufacturers and their total represents over half the sand lime brick made in the United States.

The price received ranged from $10 to $16 and the average for the country was about $13. Two producers reported increases in price and four reported decreases. It is evident that certain producers located in districts suffering from agricultural depression or in overbuilt areas were forced to cut down production. Below are listed the various data on sand lime brick for the months of November and for 1926.

Sand Lime Brick Statistics for November and 1926

	*October	†November	‡Total1926
Production	16,178,000	16,923,000	193,772,000
Shipments (rail)	4,890,000	6,363,000	94,097,000
Shipm'ts (truck)	12,344,000	10,240,000	102,668,000

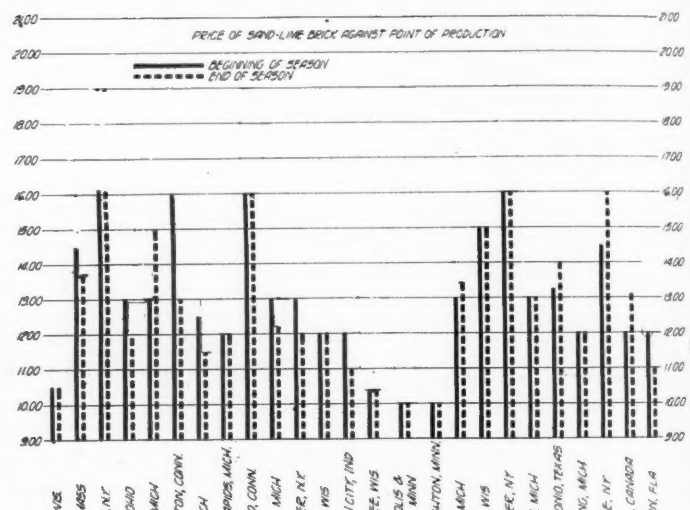
Stocks and Unfilled Orders at End of October, November and December, 1926

	*October	†November	‡December
Stocks	8,613,000	8,953,000	7,722,000
Unfilled orders	19,325,000	18,150,000	11,600,000

*Revised to include statistics for three more plants not reporting in November.
†Incomplete—one plant not reporting stocks and two not reporting unfilled orders.
‡Incomplete—three plants not reporting stocks and five plants giving no data on unfilled orders.

It is interesting at this time to note the steady progress being made in this industry. In 1923 there were 31 producing plants with a total production of 213,425,000 brick, having an average value of $11.58 per 1000. In 1924 the number of plants increased to 37, which produced 283,417,000 brick, valued at $11.76 per 1000. Figures for 1925 show that 41 plants were in operation and 308,703,000 brick produced with average value of $12.04 per 1000. During the past year there were 43 plants with an estimated total production of roughly 400,000,000 brick. There is little doubt that sand-lime brick is finding its place and favor among builders and architects and every reason to believe that with "quality" as a keynote, the continued success and prosperity of the industry will be assured.

It was thought that competition from imported sand-lime brick offered at lower prices would cut into the business of eastern seaboard plants. On the contrary, the producers there enjoyed one of their best years; several reporting in past months that their entire production went to fill orders and there were still large orders on the books to be filled. The Florida sand-lime brick industry suffered with other industries in that section after the hurricane. Business there has not recovered to expectations and, from reports, building activities in Florida will be rather slow for a time at least.



Price quotations of sand-lime brick at beginning and end of season at various producing points

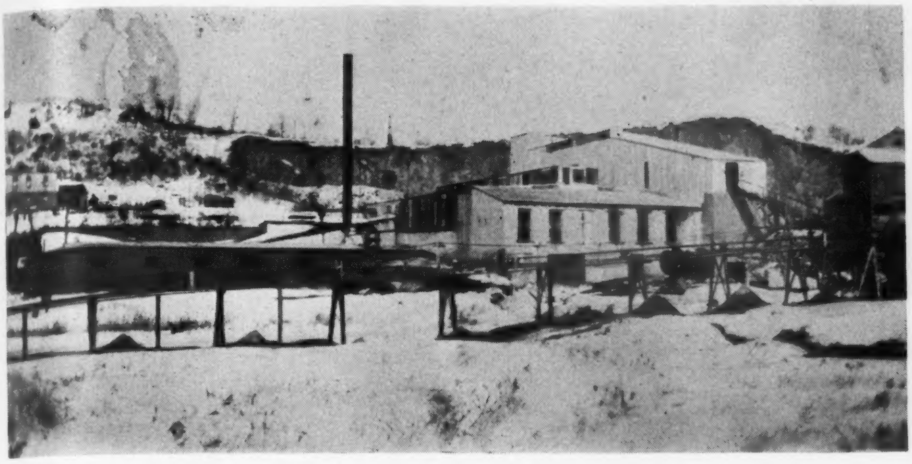
The distribution of sand-lime brick among the classes of construction varies greatly in different localities. An average for the country shows that about 35% of the brick went into factory buildings, 25% into dwellings and the remainder, 40%, into business buildings, such as offices, theaters and others. The prejudice against the use of sand-lime brick for all construction has been overcome to a great extent in the sections of the country where clay brick has long been used. What the industry needs is a concentrated national advertising campaign directed to architects, contractors and all others interested in building materials stressing the advantages of sand-lime brick and helping clear away any misapprehensions concerning its quality which now abound in many places. Further, the research work should be continued in an endeavor to produce an even better product, and when a definite standard of quality has been reached, the Sand Lime Brick Association should do all it can to keep the producers united in maintaining this high and uniform quality. It is well to remember that one poor lot of sand-lime brick discredits the rest though they may be of the highest quality. A great step towards standardization was taken this past year when the manufacturers agreed to reduce the number of different sizes of brick made from 14 to 3. This was in accordance with the recommendation of the standardization committee of the U. S. Department of Commerce.

Considerable Plant Improvement

Several of the plants are contemplating additions and improvements which will undoubtedly lead to increased production and efficiency. The Sand Lime Products Co., Detroit, Mich., is putting in underfeed stokers with forced draft, a feed water heater with condensate return system and otherwise improving their steam generating unit. Steel hopper bins will be installed over the brick presses early next year. The labor-saving machinery and automatic handling equipment at this plant formed the basis for an interesting article published in ROCK PRODUCTS, April 18, 1925 issue. The Atlas White Brick Co., Atlantic City, N. J., is planning to increase their capacity by the erection of a new three-unit plant. Two new plants are reported to be planned for Florida. The West Coast Brick Co., Sarasota, Fla., is said to have purchased 200 acres of silica sand land in Hillsborough county, Fla., on which a 45,000-brick-per-day plant will be erected and Burt Bros., Polatka, Fla., expect to start work on a new plant at that city early next year.

Winchester Plant Rebuilt

The Winchester Brick Co. has rebuilt its plant at Woburn, Mass. The plant was destroyed by fire on October 2. Operation is now again on full time basis of two



Rebuilt plant of the Winchester Brick Co., Woburn, Mass.

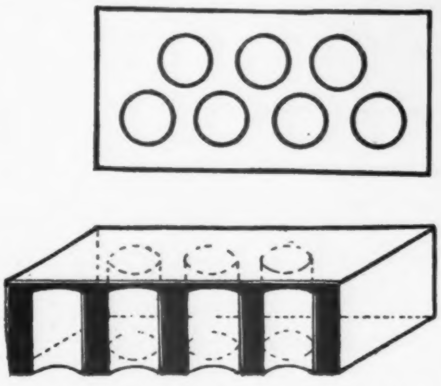
nine-hour shifts. The new plant is constructed along lines similar to the old, wooden frames covered with corrugated sheet zinc. All equipment is now driven by individual electric motors. This replacement was made because the steam boiler was not of sufficient capacity to take care of both the kiln requirements and furnish sufficient power. A new open end rod mill has been installed and will be used to grind and mix the sand-lime mixture that the three wet pans used to do.

Hollow Brick Successfully Made

This past year has seen the introduction of hollow sand-lime brick. Two companies the F. Komnick Co., Elbing, Germany, and Dr. Bernhardi Sohn, Eilenberg, Germany, have placed on the market presses for the manufacture of this kind of brick. The weight of brick is said to be reduced about 25%, hardening proceeds in the steam chamber at a more rapid rate and less material is required for their manufacture. The tests are said to show a compressive strength for the hollow brick quite comparable with similar brick made of clay.

Lime Products, Ltd., New Plant

One of the most recent sand lime brick plants is that of the Lime Products, Ltd., of Montreal, Que., a subsidiary of the Standard Lime, Ltd., Joliette, Que., one of the largest producers of lime and sand in the Province of Quebec. The company operates



A German type of hollow sand lime brick

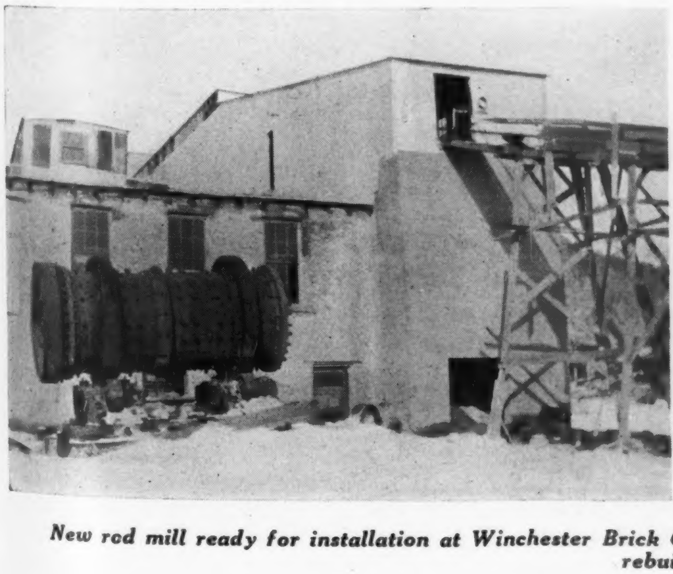
a Blue Diamond mixed mortar plant and by a slight change in location of the mortar mixing machinery and with the addition of about 1500 sq. ft. of floor space it was possible to install the two-press brick plant. This was done without interrupting the operations of the mixed mortar plant which was on a full capacity basis. The work of putting in foundations for the edge runner mill presses, cylinders, turn-tables was carried out with dispatch. Some delay was caused by it being necessary to blast the rock bed at the plant to permit the erection of bases for the presses. Despite this all the machinery, steam boiler and hardening cylinders were in place early in November, or about five months after the work had started.

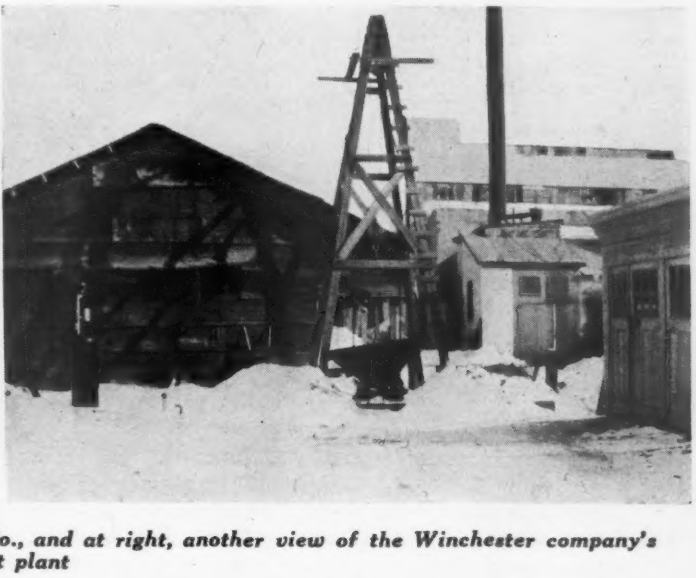
The sand used is unwashed, pit run sand

Lime Products, Ltd., sand-lime brick plant at Montreal—the new addition is shown here

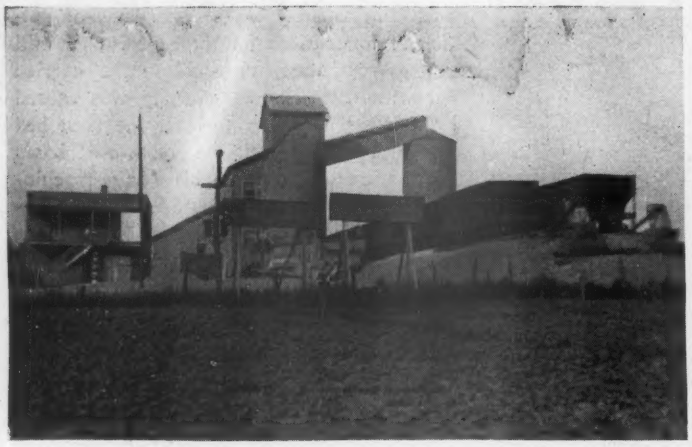
dug from one of the company's pits near Montreal. This sand is a very pure product and is also used at the mixed mortar plant. After elevation to the top of the plant it is passed through a rotary screen and into a large storage hopper. A pulverized high calcium lime made at the Joliette plant of the Standard company is used and this is also raised to a storage hopper at the top of plant. As needed for making either sand-lime brick or mixed mortar, the necessary amounts of lime or sand are drawn from these hoppers.

The sand for the brick manufacture is drawn from storage into a measuring hopper

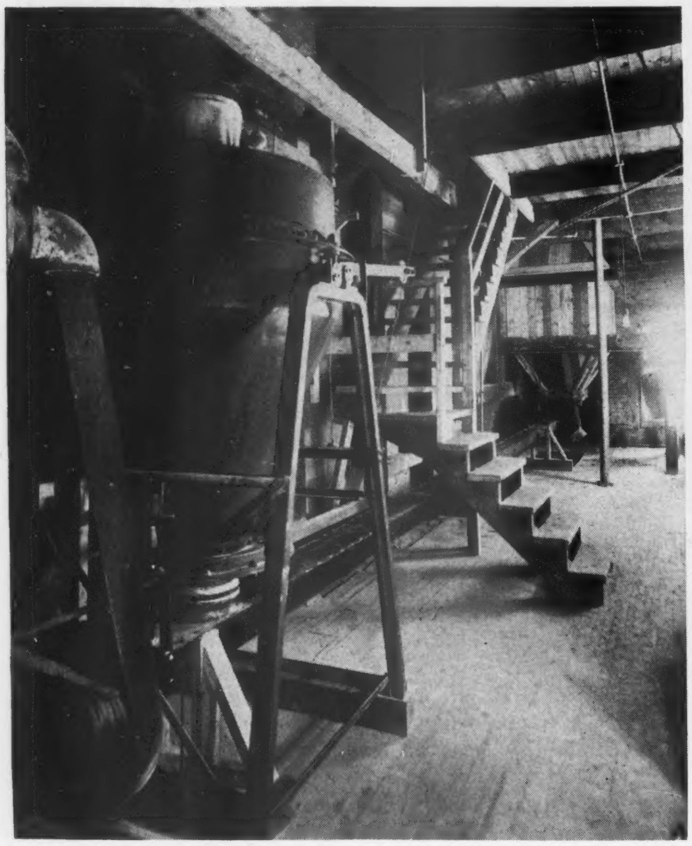
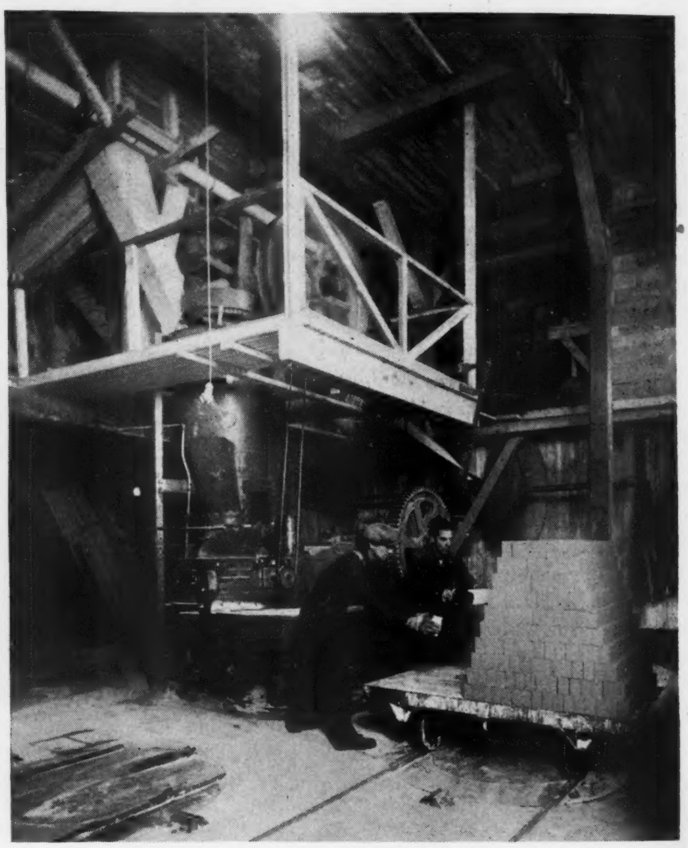




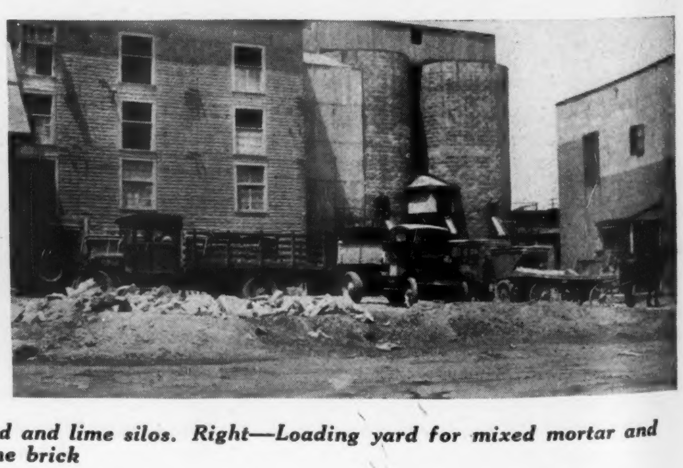
New rod mill ready for installation at Winchester Brick Co., and at right, another view of the Winchester company's rebuilt plant




Left—The Lime Products, Ltd., plant before the addition of the sand-lime brick manufacturing unit. Right—The completed plant after changes and additions were made

Interior of plant showing (left) sand and lime measuring devices and (right) one of the brick presses with attending workmen loading green brick on car

Left—Rear of plant showing conveyor gallery leading to sand and lime silos. Right—Loading yard for mixed mortar and sand-lime brick

equipped with a shut-off gate which is set to allow just enough sand for one batch to pass into the mixing drum directly underneath. The pulverized lime passes to a bucket elevator and dumps through a hopper onto a screw conveyor which feeds a lime container and weighing apparatus. This container is also equipped with automatic shut-off gates and this allows the correct proportion of lime for the batch to be drawn off and pass into the mixing drum below. Two thousand pounds of lime can be handled with this machine every 10 minutes.

When the required amount of sand and lime is in the drum, the cover is secured with swing bolts, and the drum set in motion. Steam is then turned on until the pressure gage reads 50 lb. which is sufficient for the slaking and mixing of lime with the sand. This pressure is retained for a period of 20 minutes, after which time the steam is blown off. The drum is equipped with a safety valve which does not permit steam pressure to exceed 120 lb. After a period of 30 minutes, the mixed material is dropped into mixing hopper situated directly underneath the mixing drum.

A twin shut-off gate at the bottom of mixing hopper allows the mix to pass freely into the feeder of edge runner mill which is situated directly underneath the mixing hopper. This distributing device feeds the material uniformly onto a steel rotary grinding surface and beneath two broad steel runners, each of which rotate in opposite directions, which pull the material apart and at the same time grind the mix and throw it automatically into an elevator boot after one pass through the machine. The elevator is connected directly to the edge runner mill.

The mix is then elevated to a belt conveyor which passes it into a press feeder which distributes the mix into a service pan located directly underneath from where it passes automatically into the press moulds. The green brick are then placed on steel top brick cars at the rate of 2600 per hour by two men, a third man relieving each half hour. As each car is loaded, it is pushed onto a self-propelling transfer car which is operated by one man and run into the hardening cylinder. The plant is at present equipped with two of these long hardening cylinders, each of which holds 16 brick cars.

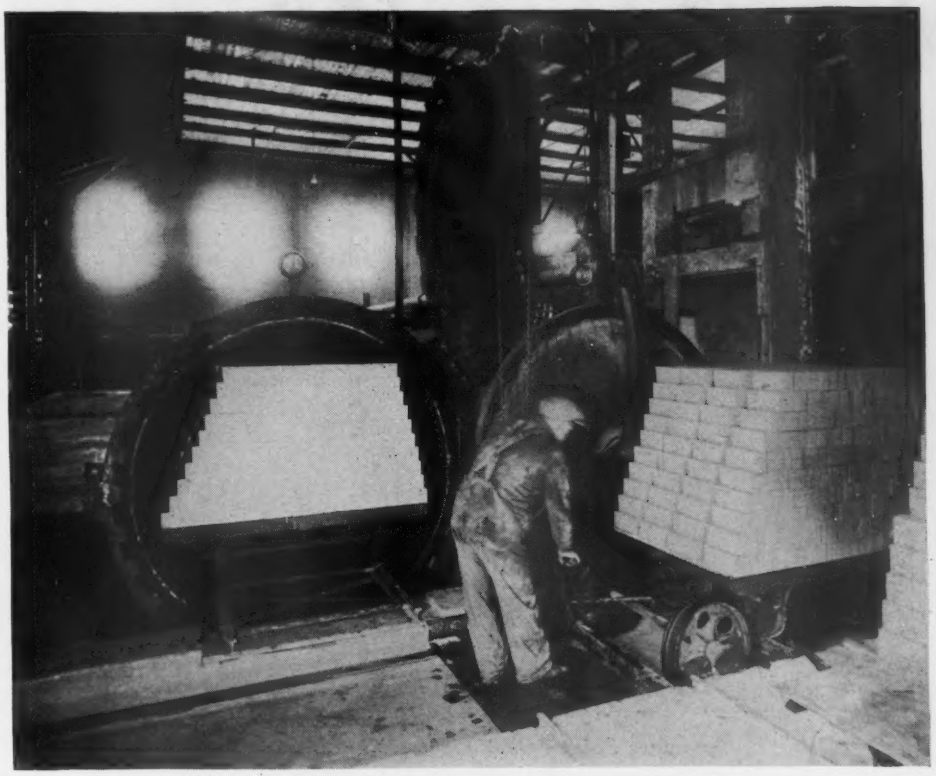
The hardening cylinders are loaded and the door closed securely and the steam turned on gradually until a pressure of 120 lb. is reached which is retained for a period of 8 hours, after which the steam is blown off and the doors opened. The cars are pulled out and the brick are then ready for shipment. The steam for hardening cylinders and mixing drum is supplied by a 60 in. diam., 16 ft. horizontal tubular boiler designed for a working pressure of 150 lb. per sq. in. A 50-hp. electric motor furnishes the necessary power for the operation.

Eight men and a foreman make up the brick plant's working force as follows:

Three men at the brick press, one man each at the mixing department, lime elevator and sand elevator and two men at the hardening cylinder, and loading of finished brick.

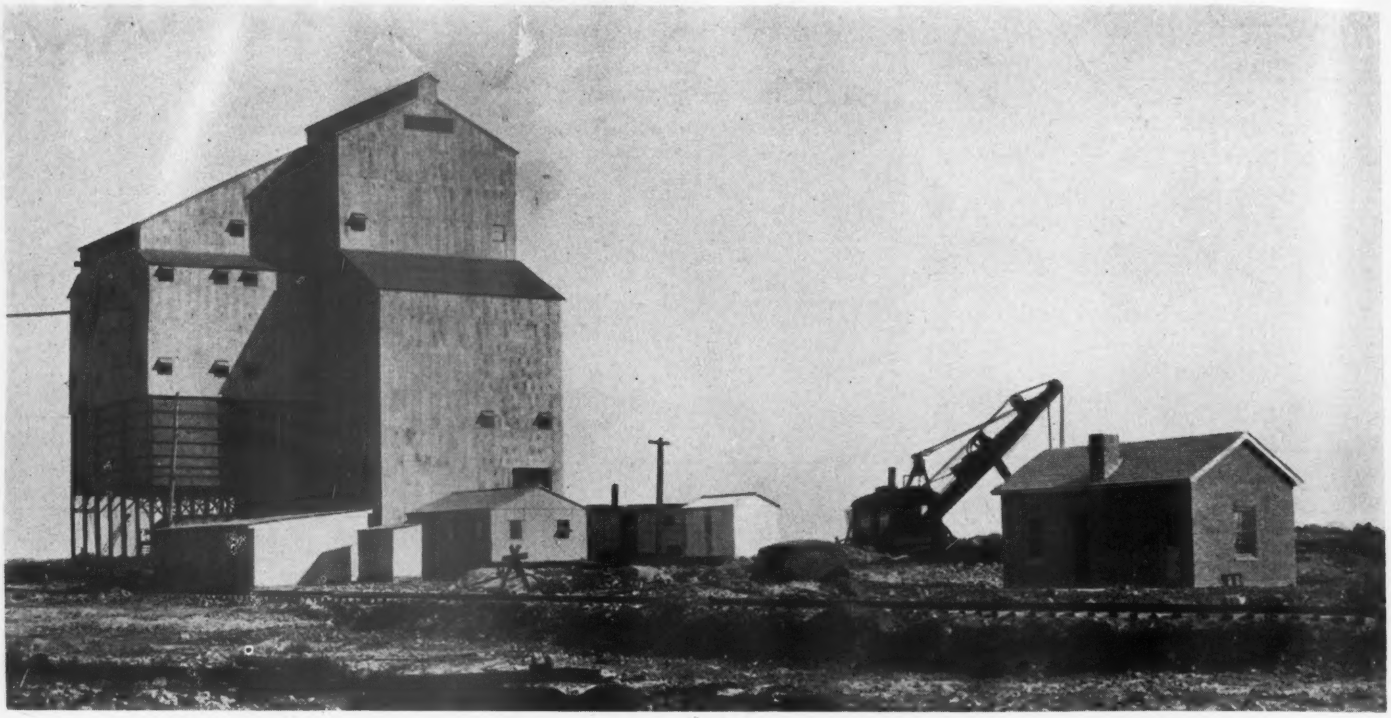
The plant has been arranged so that motor trucks can back to the end of the transfer track and the complete load of piled brick on brick cars can be lifted intact and loaded on the motor trucks in one operation by a Komnick "Simplex" loader.

The changes at the plant were under the direction of the engineer of the Standard Lime Co. The brick machinery was furnished and erected by the Komnick Machinery Co., of Detroit, Mich.



Finished brick on cars ready to be pulled from hardening cylinders

Showing the edge runner mill (left) and the 2-yd. mixing drum used at the Lime Products, Ltd., brick plant



Sparrows Point (Md.) plant of the Standard Slag Co., one of the notable plants built in 1926

Crushed Slag Has Best Year in Its History

All Producers Reporting Say Production Was Increased and Prices Did Not Drop Throughout the Year

THE crushed slag industry undoubtedly had the best year in its history. Production was considerably increased and the price remained firm. To judge from the reports of producers, there was no part of the country in which slag is produced in which these favorable conditions did not prevail.

Estimates of production increases and decreases were not received in sufficient number to permit an estimate to be made by the weighted average method. But taking the data received as representing the whole, it is estimated that the year's production will fully equal 10,000,000 tons. This estimate is checked to a certain degree by personal observation and private correspondence received from those most familiar with the industry.

Both increases and decreases in price were reported but these so balanced one another that the average price throughout the country was practically unchanged throughout the year for the ordinary commercial sizes. Roofing slag prices, however, dropped a trifle at the close of the season.

As to prospects, all who wrote of them said that they were good or at least very fair. The least favorable comment on the prospects for 1927 was that "the business seems to move along with the general business of the country, which seems to tend more and more to close competition, slowly decreasing prices, and correspondingly requires closer attention to detail, harder work and more investment in order to maintain and increase production and sales." This may be considered a fair presentation of industrial conditions, but it is one with which industry seems to be well satisfied. Other producers said that they looked for good business during 1927 on account of increased railroad building and road work.

The labor situation was everywhere reported good. Wayside pit gravel competition was nowhere considered serious, and without exception producers reported that buyers were demanding a better quality of product.

Among obstacles to selling one producer spoke of the usual "knocks" against slag. But it seems to Rock Products editors that the knocks against slag as concrete aggregate are being much less heard and in many quarters they have ceased altogether. Experience has not shown the dire calamities to structures of slag concrete that were predicted and to go on with such predictions marks the knocker as merely prejudiced and even silly. Unfavorable freight rates was mentioned as an obstacle to selling by one producer.

New Plants and Improvements

Some important new slag-crushing plants were built during the year and more are to be built in 1927. Among the plants under construction is that of the Buffalo Slag Co., Buffalo, N. Y., at Erie, Penn. The latest reports are that the site has been cleared and the plans are ready and by this time it is probable that the contract for the concrete work has been let.

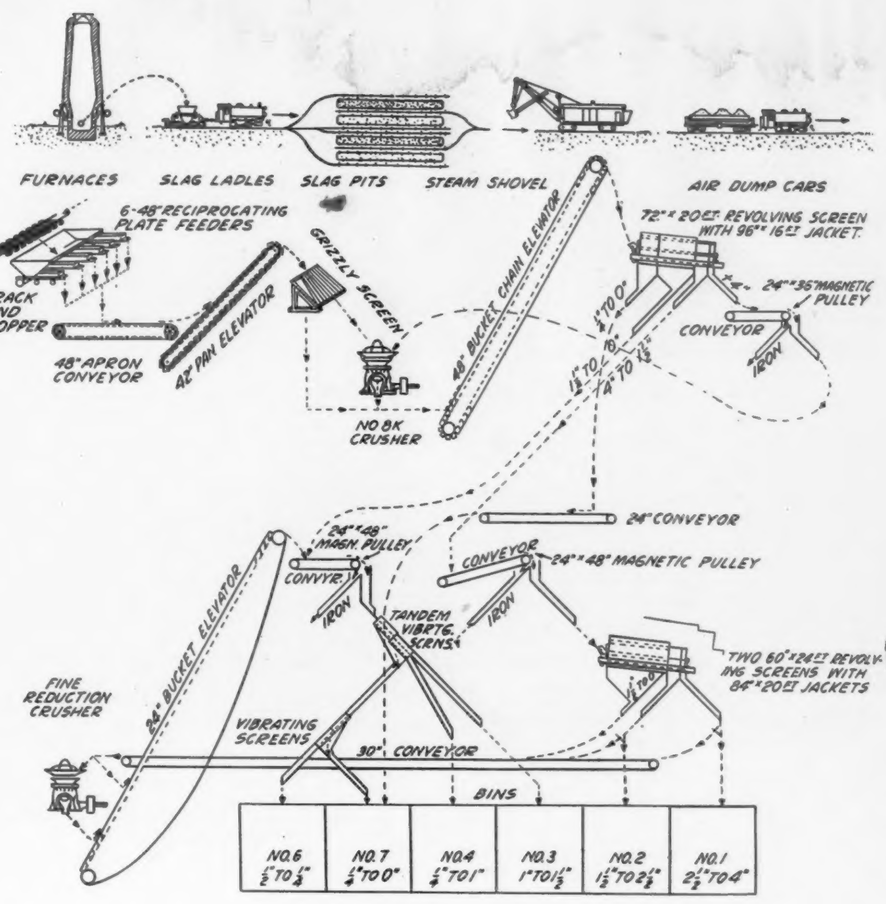
It was reported by local papers that a plant was to be built at Allentown, Penn., by the Duquesne Slag Products Co., of Pittsburg, to crush accumulated slag from old furnaces in Allentown. The report was unauthorized, but it is possible that work on such a plant may begin in 1927.

The Standard Slag Co., Youngstown, Ohio, built one of the notable plants of the year at Sparrows Point, Md. As will be seen from the accompanying flow-sheet, this plant will work on current slag from furnaces, recovering it from cooling pits by a steam shovel. From the track hopper it goes by reciprocating feeders and a pan elevator to a grizzly and the oversize goes to a No. 8K crusher. The material is then elevated to a 72-in. by 20-ft. revolving screen with jacket making four products all of which pass over magnetic pulleys to remove iron. The finished sizes of slag (4 in. to 1½ in.) are sent to a 60-in. by 24-ft. revolving screen with 1½-in. openings and a jacket and the oversize of this screen may be sent either to bins or to a fine reduction crusher. The undersize and intermediate sizes of the first screen are sent to tandem

vibrating screens which also take the discharge of the fine reduction crusher. The sizes made are No. 1 (2½ in. to 4 in.) down to No. 7 (¼ in. to 0) and all these sizes are made with a very simple flow-sheet. The only return is that of the oversize of the first revolving screen (plus 4 in.) which goes back to the 8K crusher. It is to be noted that rolls are not employed for a secondary crushing as they are in so many slag plants. Crushers and main screens for this plant are of Allis-Chalmers make, the vibratory screens are "Hum-mers," made by the W. S. Tyler Co., and the 42-in. pan conveyor and 48-in. chain bucket elevator with other conveying and feeding equipment were made by the Webster Manufacturing Co.

The plant has been completed for about two months and is operating under the name of the Maryland Slag Co. W. E. Bliss, vice-president of the Standard Slag Co. (which operates about 20 plants in several states) is in charge of operations.

In the southern field the Birmingham Slag Co., Birmingham, Ala., which is the largest producer, had a fire, which badly damaged its plant at Alabama City, in October. Thirty-eight days afterward the plant was back in production with all the old construction, which was of wood, replaced by steel construction. Fortunately the track hopper and track scales were not damaged. This company, it will be remembered, built two new plants last year which were described in Rock Products, November 27, 1925.

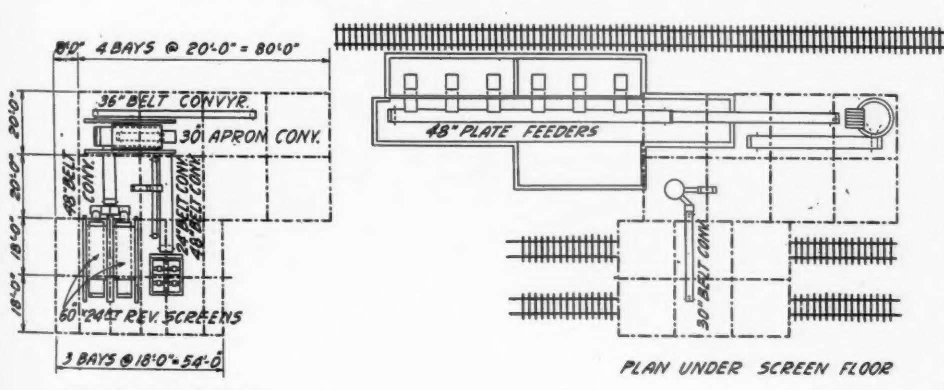


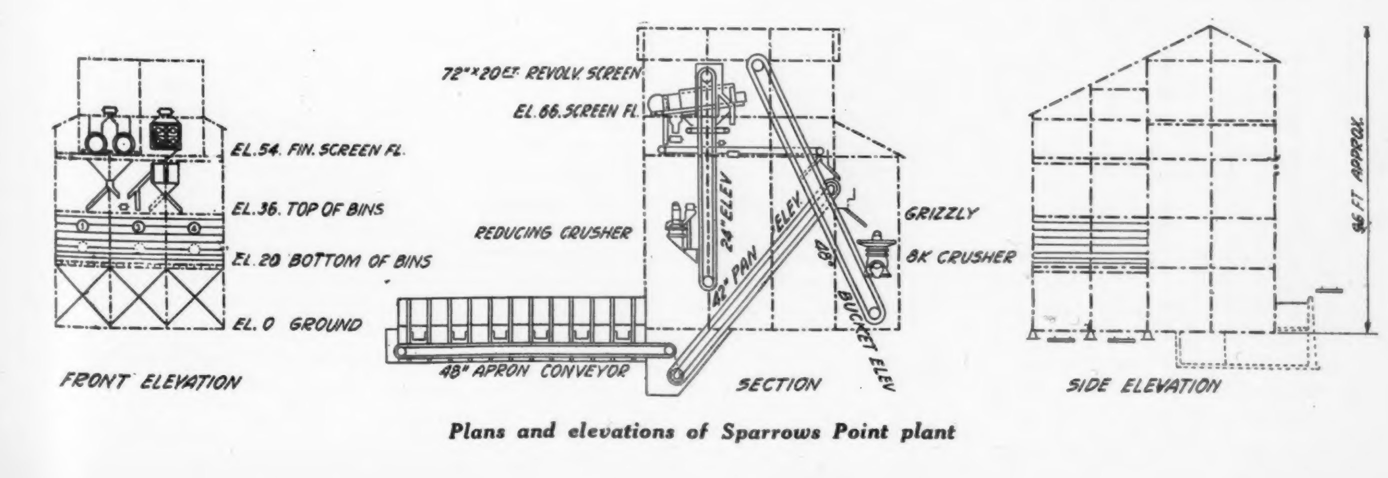
Flow-sheet of Sparrows Point plant

The Birmingham Slag Co. turns a considerable part of its output into concrete products, manufacturing both concrete brick and a concrete tile to which it has given the name of "Slagtex" tile. This year it added to its concrete products department equipment for making "Stonetile," a poured tile which has a high resistance to compression. The Stonetile will be sold especially for bearing walls and partitions and the Slagtex tiles will be used where resistance to compression is not so important a factor. Lightness, a feature more or less common to all concrete products made with slag aggregate, is one of the valuable characteristics of this patented kind of tile.

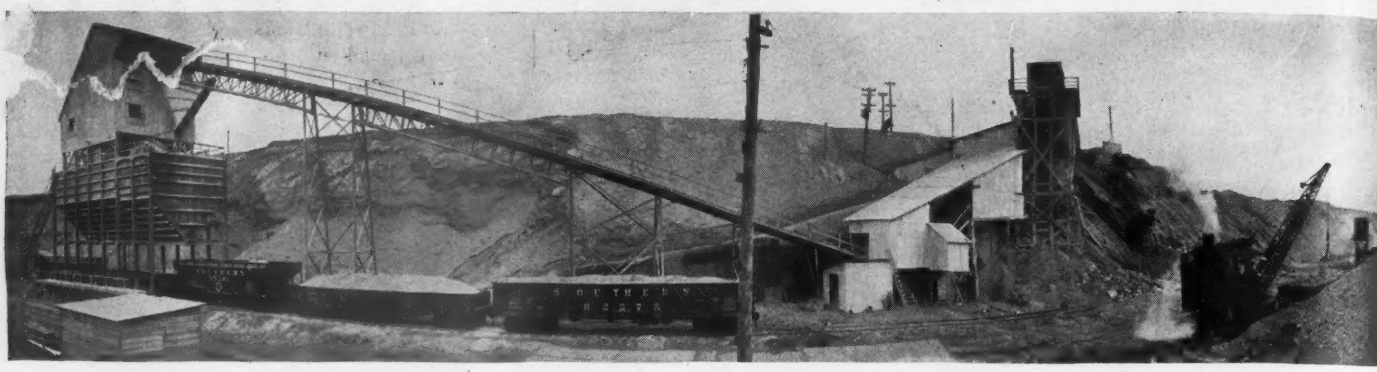
The Woodstock Slag Corp. of Birmingham also had its plant (which was described in the June 26 issue) damaged by fire. The damage was so great in this case that the entire plant had practically to be rebuilt.

This plant crushes current slag from furnaces, recovering it from cooling pits with a 70-ton Bucyrus shovel. It is dumped from cars over a bar grizzly with 2-in. clear open-





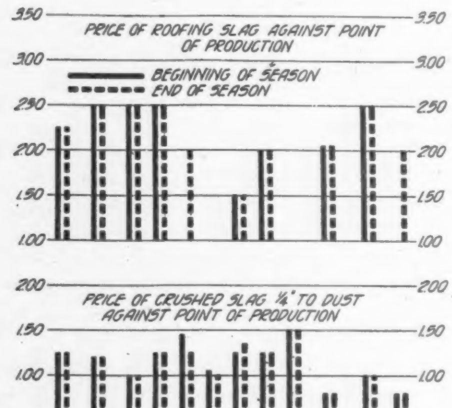
Plans and elevations of Sparrows Point plant



Panorama of the new plant of the Woodstock Slag Corp., which replaces the plant burned in July, 1926

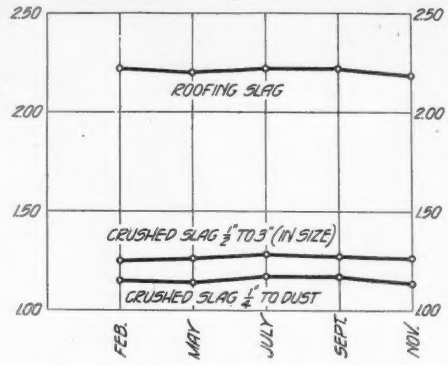
ings and large pieces of tramp iron are hand-sorted from the oversize. Undersize of the grizzly goes to a magnetic separator. Oversize goes to a16 -A Telsmith crusher set to 3 in. Crusher discharge goes to a magnetic separator made by the Magnetic Manufacturing Co. and then to two Allis-Chalmers 60-in. screens 16 ft. long. Screen openings are changed according to the requirements for secondary reduction.

After passing this first (scalping) screen the material is elevated to the screen house. The scalper oversize is crushed in a Kennedy



Price of crushed slags at points of production

gearless No. 37 crusher and a Telsmith 3 F fine reduction crusher, both usually set to 1 in. opening. The discharge of the crushers goes to a 30-in. elevator 200 ft. long and is then elevated to the screen house. This conveyor was built in Birmingham to the company's own designs. It has Stearns idlers with Timken roller bearings.



Seasonal price variation in crushed slag products

There are 10 Hum-mer screens each 4 x 5 ft. in the screen house. All material flows over the screens and into the bins by gravity. The bins, and in fact all the new constructions is of steel and the bins hold 800 tons. The plant was designed for 200 tons per hour capacity and has had no trouble in maintaining it from the start. One important feature is that belt and chain drives have been eliminated by the use of Jones speed reducers, except in the cases of crushers which are belt-driven to avoid the chance of breakage from tramp iron in the feed.

The new plant is practically of fire proof construction in all its parts.

Agstone Prospects Good for 1927

SEVERAL rock products industries were seriously affected by the heavy rains and flooding rivers which were reported from so many parts of the country in 1926, but probably the agricultural limestone industry suffered more than any other. The rains came in the early fall at the time when the heaviest shipments are usually made. Farmers could not get to town to haul the limestone to the farms and if they could get the stone to the farm they could not spread it on the fields. In consequence what had promised to be by far the year of heaviest production and sales turned out to be no more than an average year.

At the same time this was a year of great progress for agricultural limestone. The meetings held in Columbus, Ohio, June 24 and 25, in Buffalo, September 30, and in Chicago, October 28, marked great advances in the industry. At the first named meeting, the National Agstone Association was able to see some important results from the work carried on by the fellowship established at Ohio State University. Two papers presented brought the knowledge of fineness requirements to a point far beyond that reached by any other investigators, either European or American. One was "Relation of Fineness to the Efficiency of Limestone," by L. B. Broughton, and the other, "The Relation Between the Fineness of Limestone and Its Rate of Solution," by Herbert F. Kriege. It now appears from this work that only two grades of limestone need be made, one all through ¼-in. and 30% through 100-mesh and the other all through 10-mesh and 40% through 100-mesh. Many other valuable points were made by these papers, which were published in Rock Products for July 10, 1926.

At the Buffalo meeting, which was reported in detail in the issue of October 16, the New York state producers organized as the Eastern States Limestone Association and affiliated with the National Agstone Association. At the Chicago meeting the important feature was the description of the organization which has been formed by the Wisconsin producers, under the very liberal laws of that state, which has been characterized as a "beneficent trust." This association works through 450 dealers and has five men on the road who sell the idea of liming to the farmers. A uniform product, 90 to 95% through 10-mesh is made by all producers.

The matter of "ironing out the peaks" in shipments is considered to be one of the most important before the industry and it is believed that some method can be devised which will do this successfully through the various associations comparing methods and adopting the best from each.

The association situation at present is somewhat unsatisfactory. There are many local associations in the United States, but

not all of them are affiliated or even connected with the National Agstone Association. At the coming convention of the National Crushed Stone Association, to be held in Detroit, January 17-20, it is to be hoped that the local organizations will all be combined in some way to form a true national body, since the problems of the industry are more and more becoming national as well as local.

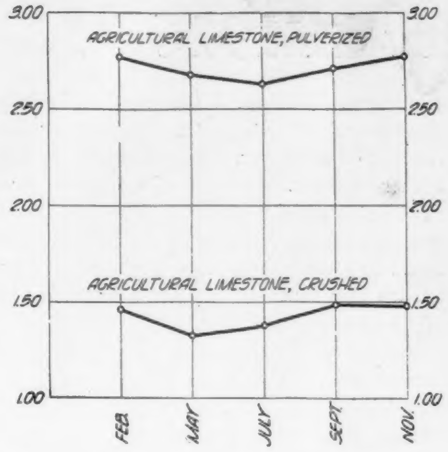
Reports from Producers

In New England, it appears that demand for agricultural limestone could not absorb the production readily, to judge from the few reports received. One of the obstacles to sales in this locality noted was "competition from concerns who at times have material which is, to them, waste, and which they endeavor to sell without regard to production cost." Prospects are considered fair.

In New York state, production apparently showed some small increase over that of 1925 and conditions were in general satisfactory. The outlook for 1927 is considered to be good.

Pennsylvania producers reported more freely than those of some other states, but two out of three reported that bad weather had seriously interfered with sales. One producer estimated that the agricultural limestone business had fallen off as much as 50%. Prospects in the main were reported as only fair for the coming year.

Ohio is another state in which the weather seriously affected sales, the rain coming just at the peak of the season. The production of agricultural limestone in Ohio will probably show a considerable decrease from the production of 1927. Prospects are considered to be only normal by one important producer, another, who is also a large producer, considers them to be very good and others are noncommittal. The impression gained by talking with producers during recent visits to Ohio is that the agricultural limestone



Seasonal fluctuations in agstone price quotations

business wll be very good provided the weather permits shipping.

The campaign which resulted in such an enormous increase in agricultural limestone consumption in Illinois has created a very strong market in that state. One prominent producer reported in early August that his production was away behind his sales and farmers were still calling for limestone even though the price had been increased. But, as in other central states, rain put a stop to shipments a little later. The greatly increased sale of agricultural limestone is said to have largely consumed the accumulations of screenings at plants and current production of screenings was not able to supply the demand so that more finer sizes had to be produced and this has raised the price throughout the state. Prospects for the coming year are considered very fair.

Indiana producers spoke of an "unseasonable autumn" as one of the conditions that brought about a lowered production, but also said that a somewhat decreased agricultural situation played its part. Prospects for 1927, however, are considered to be good. Farmers are beginning to recognize that with present day conditions liming is not a luxury but a necessity. One prominent Indiana crushed stone producer recently said that he was preparing to increase considerably his production of agricultural limestone.

Reports for Tennessee, Kentucky and Georgia, in which states all the principal agricultural limestone producers of the south, would indicate a very good season. While heavy autumn rains and floods were holding back production and sales in the western states the season was unusually dry in the south and southeastern states. This made business good, as it is at this time that the demand for agricultural limestone is strongest. Prospects from this group of states are reported as good and even very good. Lime is used in this part of the country on tobacco fields and general crops and these have not been depressed in price as has the cotton crop.

West of the Mississippi river agricultural limestone has not the extended use that it has in the central states, but its use is certainly increasing. This is perhaps more noted in Iowa and Minnesota than other states. One Iowa producer writes: "There has been a general agricultural depression but farmers are holding their own and some are making money. This should be a banner year for agricultural limestone." And again, "Farmers are seeing the value of agstone. Agstone will be used to the limit of production in this locality." "Business has been good," reports another producer. The recognition of the necessity of liming for growing legumes seems to be well recognized now, and it is probable that Iowa will show increased production in 1927.

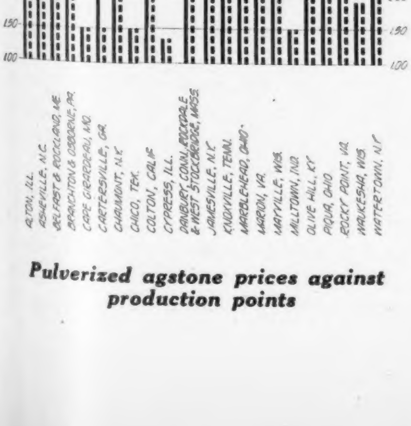
In Minnesota from which only meager reports were received, conditions were apparently good with an increasing production of agricultural limestone.

Nebraska producers very little agricultural limestone. In Kansas, conditions were apparently good, to judge from the report of one producer who crushes more than half of his output to agricultural limestone. He reported a 100% increase in production. In Oklahoma, crops have been good, except cotton and the use of agricultural limestone is thought to have been about normal.

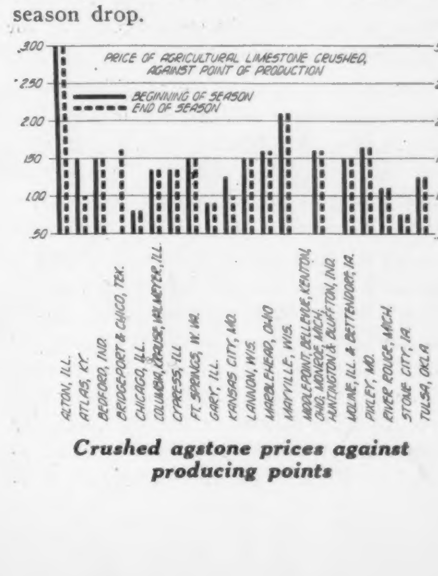
In Texas, crushed stone producers generally did not have so good a year as they had in 1925 and agricultural limestone production seems to have suffered along with other branches. One producer adds to his report that, "Crushed fines from ⅛-in. down to dust are most suitable for general agricultural purposes or for use on lands on which it is desired to grow legumes." Prospects are generally believed to be for much better conditions in Texas than those of 1926.

One Pacific Coast producer reported slack business with agricultural credits weak, but this is not supposed to be typical of the whole coast.

The prices of agricultural limestone, both crushed and pulverized, are shown to have been about the same at the end of the season as they were at the beginning, but there was the usual mid-season drop.



Pulverized agstone prices against production points



Crushed agstone prices against producing points

Talc Industry in 1926

A SURVEY of reports submitted by leading producers located in the largest talc producing areas in United States indicates that the amount of talc mined in 1926 was from 5 to 10% less than last year. The average price per ton for all grades was slightly above that received in 1925. The decline in production can be traced to a substitution for other materials by some of the industries using talc in large quantities. This occurred in the early part of the year but the replacement was evidently unsatisfactory for these same consumers in the later months placed orders in larger volume than ever before. Nearly all talc producers are optimistic regarding 1927 and expect it to be one of the biggest years ever in the industry. However, the determining factors in the demand for talc depend greatly on the continued prosperity of the rubber and paper industries, which are in turn dependent on the general prosperity of the country for their success. And considering this from the standpoint of economic experts, the talc producers have a good basis for their optimism. An excellent review of the industry in the past year which has been prepared by J. B. Aikman, of the Vermont Talc Co., Chester, Vt., is given below.

Vermont Talc Industry

By J. B. Aikman

Manager and Assistant Treasurer, Vermont Talc Co., Chester, Vt.

It is of course too early to obtain statistics covering actual production and sales of talc for 1926, since these will not be available until sometime after the close of the year. While not in position to speak with certainty as to the experience of other talc producers, close observation of conditions that have prevailed in the trade this year, seems to warrant the conclusion that the total volume in tons, as well as value, has been slightly under that of 1925. Demand throughout the current year for ground talc has shown a tendency to be erratic and irregular with some months exceeding and others falling below the same months of the previous year.

Careful analysis of trade conditions relating to talc seems to lead one back to the same well-known difficulty affecting this, as well as many other non-metallic minerals. This is the lack of standardized methods for grading, generally acceptable to producers and consumers alike. Another hindrance is the absence of definite information as to properties of talc, both physical and chemical, that are essential in the processes for which it is employed in different industries.

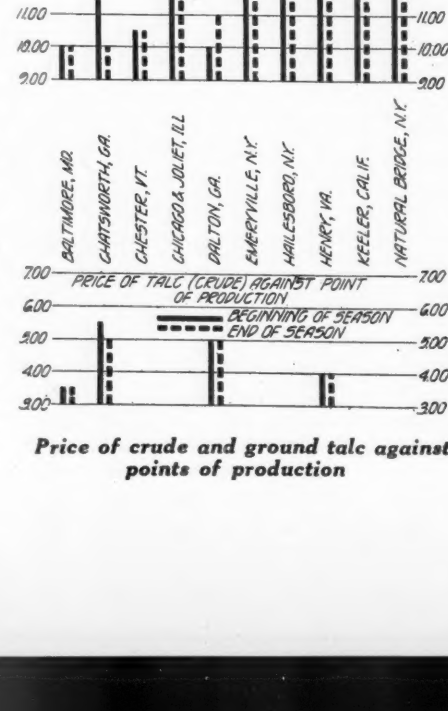
The requirements demanded of talc by different concerns in the same industry, whether expressed in formal specifications or otherwise, are often inconsistent and even contradictory. In some instances they include features of no possible consequence or interest to the buyers. For example, in the matter of color, or degree of whiteness, also of "slip," some consumers who are most exacting about these, have actually no interest in them whatever, as their use of talc is such that superiority in these properties is of no advantage to them.

Much has been written recently on the subject of "The New Competition," by which is meant not the old form of commercial antagonism between producers and sellers of the same commodities of merchandise, but the far more serious and formidable competition of other materials or products.

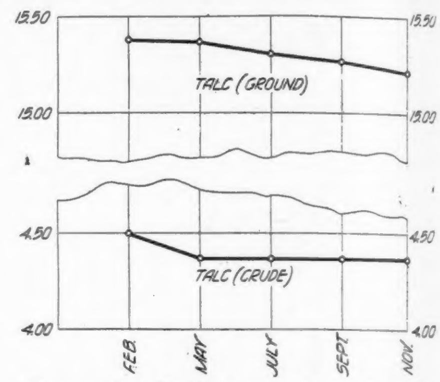
Competition from Substitutes

This competition is common to the production of all sorts of raw materials and products and many commodities and kinds of merchandise that seemed indispensible have been altogether displaced by new substitutes and the business in the former has become extinct. It is not apparent that, in a general way, less activity has prevailed this year in those industries that have heretofore been considered the largest consumers of talc. It is only the fact that here and there other minerals claiming to serve the same purpose have to some extent invaded the fields that have always been regarded as belonging exclusively to talc.

A capricious tendency in demand for talc is growing more apparent, much to the annoyance and anxiety of its producers. This is due to a sort of vacillating policy, hard to explain, more or less prevalent among some of its larger consumers. The paper manufacturing industry has always been one of the larger outlets for talc, where it is used as a filler. In this industry the greatest competing material is kaolin, or china clay, especially the higher grades imported from England. It is true in some higher grades of paper the latter is distinctly preferable if not essential, but in a large variety of papers where the color of talc is suitable, it is a distinctly better filler than china clay for several reasons, chief among which is its undoubted superiority in important economic property of retention. This alone should favorably commend it as compared with other fillers to the paper trade. Paper mills making practically the same grades often pursue opposing methods, whereby some use no filler at all and others use various kinds, apparently according to whim or prejudice rather than from any consistent or scientific motives. Recently some well-known paper mills have, at the suggestion of talc producers, experimented with marked success in using both china clay and talc in a mixture of equal parts.



Price of crude and ground talc against points of production



Seasonal variations in price of crude and ground talc

"Rule-of-Thumb" Still Prevails

It is rather strange in these days of enlightened research that such wavering and rule-of-thumb methods should still prevail, and not infrequently in plants that boast of their up-to-date scientific methods. In the rubber industry the demand for talc continues very constant although occasionally other minerals are tried out as substitutes but so far without much success. The larger consumers in the rubber trade are the tire manufacturers and rubber reclaimers. In the manufacture of fine grades of soft rubber, such as druggists sundries, it seems talc is used in compounds, thereby undergoing more or less chemical changes. Hence, more exacting requirements as to properties of talc are necessary for such uses. Loss on ignition must be low or otherwise the finished products will be discolored, to say nothing of the actual loss in weight sustained.

The manufacturers of insulated wire and cables are large users of talc, but demand a product free from impurities that will impair insulation. Some variation in manufacturing processes prevails in this industry so that in

certain methods talc is thought to be unnecessary or of no advantage, while in others, high grade whiting is preferred. Generally speaking, however, talc serves the purpose much better if the quality is suitable.

A large amount of talc is used in paint manufacture, but this is restricted largely to the fibrous talc produced mainly in northern New York State under the names of asbestine, agallite, etc. The superior white shade of this product, together with the spirelike or elongated shape of the fine particles of ground material, seem to be quite essential for its use in this industry. Hence, the higher market price of this talc is readily paid by consumers because of its preferred characteristics. The roofing industry is one of the largest consumers of talc as to tonnage. Usually it is ground much coarser for this purpose, 60 to 100 mesh instead of 200 mesh and finer, as required in the other uses above mentioned.

Other materials of late have been intruding themselves for this roofing use as well. Among these are slate flour or finely ground slate. In some other instances ground mica is preferred despite its higher cost. While the color of ground slate is less desirable than talc, the low price at which it can be bought is a constant temptation for roofing manufacturers to substitute it for talc.

Outstanding Uses for Talc

Contrary to general belief, the amount of talc used in the talcum powder industry or for toilette purposes amounts to less than 3% of the total tonnage consumed. The requirements, both chemical and physical, extreme white color and perfect "slip," are so exacting that little or no talc produced in this country will meet them unless, perhaps, it is the high grade material that comes from the Death Valley region near Los Angeles in California. Talc is one of the ingredients used in compounding foundry facings, certain outstanding properties peculiarly fitting it for this purpose. Occasional attempts of other minerals to encroach upon it have so far been unsuccessful. This is one of the minor carload uses which amounts to comparatively small tonnage. About 25 or 30 other industries use talc in small amounts.

In due time and after further research work has been done, the use of talc will be largely expanded, but this is a matter of encouragement for the future and offers no help for the present. That some of its unique properties will eventually be more fully recognized and thus lead to its wider use, there can be little doubt. Among these might be mentioned its peculiar behavior under heat; in raising the temperature from normal to red heat and subsequent cooling, practically no expansion or contraction takes place. The only change is from a condition of extreme softness to such hardness that the material after heating will cut glass. Nothing has been found to take the place of so-called lava talc which is used for making electric and acetylene gas tips, switchboard fittings and for many other purposes where extreme heat and dielectric strength are required. It has been found that from 30,000 to 40,000 volts are required to pierce a slab of talc or soapstone only ½ in. thick, provided the material is free from impurities that impair insulation.

The colloidal and absorptive properties of talc, its heat resisting and heat retaining qualities are extraordinary and more effective than in most minerals. It is unlikely that any other mineral may be found that will combine such a variety of unique and useful properties as talc. For this reason the future demand for it is likely to materially increase in spite of the present competition of other materials.

Production Exceeds Consumption

Like all natural materials as distinguished from chemicals produced industrially, considerable variation in chemical and physical properties of so-called talcs from different sections of this and other countries, and indeed in the same deposit, is inevitable. Hence, the difficulty, if not impossibility of absolute uniformity as to these properties in successive runs or different lots, will be apparent. On the other hand, such perfect uniformity seems unnecessary for most uses. Under prevailing conditions the productive capacity in the talc industry is much in excess of what the country can consume. And the lack of standardized methods of grading, already mentioned, results in some injustice in its consideration by prospective buyers. Consequently the competition which the industry encounters is not only severe but in many cases more or less unfair.

It is to be hoped that eventually the true value of talc for the many uses for which it is so admirably adapted may come to be more fully appreciated. To that end, it is also highly desirable that consumers may be able to arrive at more uniform and sane specifications as to the essential requirements they must demand of this mineral in which so many valuable and useful properties are combined. The outlook for the talc industry seems encouraging for the coming year so far as tonnage is concerned. But prevailing over-production naturally begets increased competition with consequent tendency to weaken prices. If the few industries that consume the bulk of talc tonnage, especially paper and rubber, enjoy continued prosperity in 1927—as now seems probable—it is reasonably certain talc producers will share in it.

Opinions of a New York Producer

The views expressed by Mr. Aikman are in many respects identical with those of W. L. Caton of the W. H. Loomis Talc Corp., Gouverneur, N. Y. In addition Mr. Caton says in part:

"A great many different avenues of sales are presenting themselves and we believe in the not distant future that our particular grade of talc will find a ready market in this country to be converted into uses heretofore undeveloped. In fact, within the last three weeks a prospect has approached us for a very large yearly tonnage to be used in an industry that has never before used talc in its manufacturing process. It is apparently quite evident that the next four or five years will see a marked change for the better."

With regard to improvements and developments on "Loomite," Mr. Caton says:

"No. 1 mine was sunk to the eighth level and the development on the seventh level has been pushed into a new lens east of the shaft; and on the west side of the vein we found a width of 100 ft. pure talc rock. No. 2 mine was pumped out this fall and a 20-ft. vein of very good rock encountered. This property at present is only a prospect, but it now looks as if later on it would be advisable to make a permanent installation.

"'Loomite' is still in the experimental stages. It has been tested out in three laboratories besides our own, which is working at it all the time, and the experiments seem to show that for waterproofing, strength and workability we have used in the past too much 'Loomite' in our field concrete work. The New York State Highway Department has used 'Loomite' in three test sections of concrete road and the village of Gouverneur has used it in one section.

"For brick work, 'Loomite' is successfully used in cement mortars to replace lime which is usually added, and the mortar with 'Loomite' is harder and more impervious.

"We carried on a very interesting experiment on our mine and mill buildings using talc (double air floated) with oil as a priming coat in paint. Over this priming coat we put one coat of prepared paint and at the end of a year and one-half, we found very little deterioration in the appearance of our buildings. The results justified our belief that one coat of oil and talc plus one coat of prepared paint is equal to two coats of prepared paint, and costs much less.

"We have not started development work on our water powers, but for the time being we have reforested our flowage lands.

"We are constructing a new office building, 60 ft. by 30 ft., and we believe it will be unique, in that we expect to build as much of it as possible out of crude and refined talc—for example, our outside chimney is to be built of crude talc rock and the building itself will be stuccoed with talc."

Two New Talc Companies

Two new companies have been organized and are expected to enter production early next year. One of these, the Dixie Talc Corp., Atlanta, Ga., has acquired deposits near Atlanta and the other, J. H. Warner, is reported to have purchased talc land in Wauposa County, Calif., which will be developed shortly. The Georgia Talc Co. has added sufficient machinery to increase the capacity of the plant about 25%.

Feldspar Industry's Banner Year

Production About 200,000 Tons

THE amount of crude feldspar mined and shipped by producers in the United States in 1926 was about 200,000 tons or 10% more than in 1925. The average price per ton was about 5% above that of last year. The increase comes from several sources, notably extensive development work at old mines and the opening up of new deposits in the feldspar producing states. The demand for facing aggregate has led several producers to install the necessary equipment for its manufacture and has at the same time opened a fair sized market. A great majority of feldspar grinding mills increased their capacity to meet the demand from the ceramic industries. Considerable activity and new developments are reported to be under way in the feldspar mines and prospects around Spruce Pine, N. C. Indications are that a banner year for the production in that state is in sight and this has great bearing on the entire industry, for North Carolina is the largest feldspar producer in the United States. In general, conditions in the industry have improved considerably. The buyer of feldspar has ceased to make price the only consideration and is content to pay for a high grade material which conforms to his requirements.

Adirondack Feldspar Co.'s crushing plant at Wilton, N. Y.

The situation in this industry is rather different than in other rock products manufacture; the producer usually shipping the crude feldspar to a grinding plant located near the source of consumption.

Extensive Improvements Made at Many Plants

Early in the year the Adirondack Feldspar Co., Albany, N. Y., took over the properties of the Maco Development Co. at Wilton, N. Y. Extensive development work at the mine and mill were completed and considerable new equipment added. Five pits are now worked for different grades of feldspar. The daily production is about 200 tons, 100 tons of which is sold in crude form to the grinders. The remainder will be converted into crushed spar for the building material trade. For this purpose Hum-mer vibrating screens will be placed in the mill to separate the desired sizes. The entire operation is in charge of George N. Dulin, who was formerly with the Neil F. Ryan Sand and Gravel Co., Scotia, N. Y.

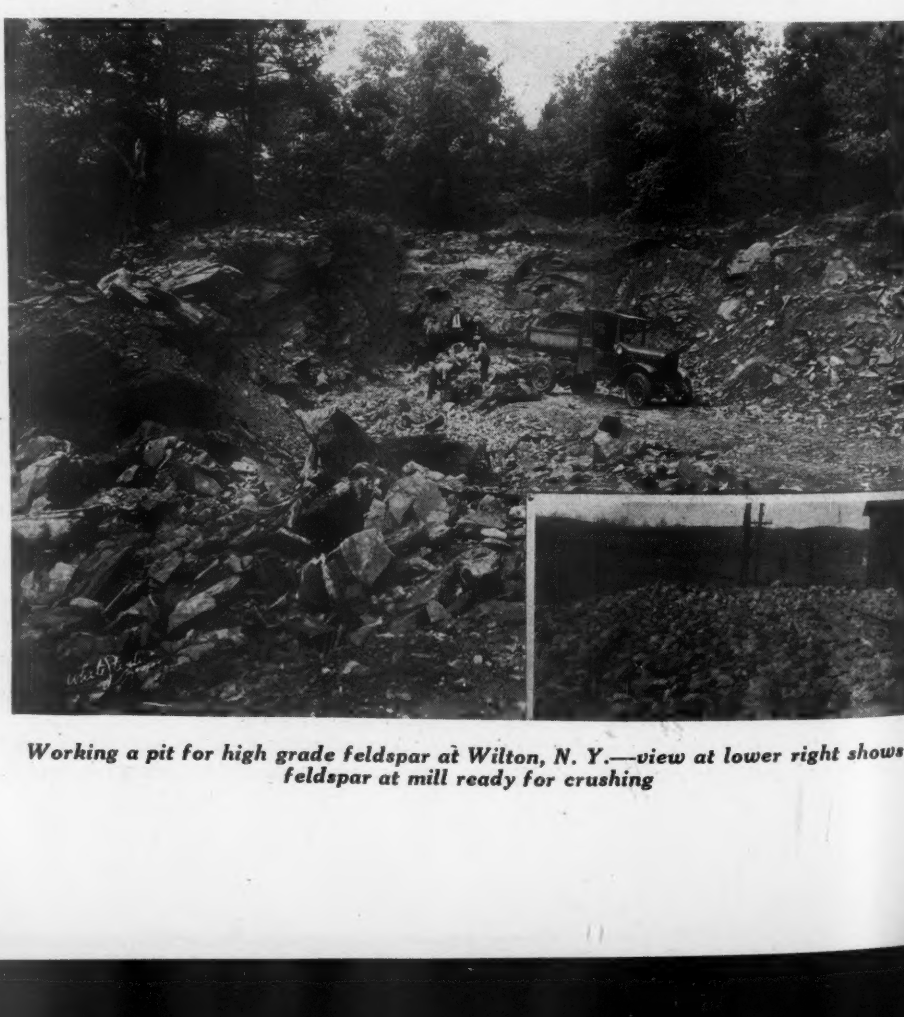
The North State Feldspar Co., Micaville, N. Y., after acquiring the well-known Goog Rock Mines, Yancy County, N. C., added considerable equipment and machinery which increased capacity. During the summer months a tunnel was driven into this mine and mining is now progressing on three different levels, under ground, and in open cuts. Production has been increased approximately 30%. Bee Ridge mine is also producing greater tonnage since the installation of a derrick to handle the waste, and the addition of a new Ingersoll-Rand tripod drill.

A three-mile electric high tension line has been constructed from the power plant to the Cedar Cliff mines to drive a new Ingersoll-Rand "Imperial Type 20" air compressor recently installed there. Due to other and more pressing developments the company has refrained from constructing the tramroad, which, however, is still under advisement. A 260-ft. tunnel is now being driven at the Cedar Cliff mine to the ore body, 90 ft. below the level of the present workings. A 70-acre tract known as the Henley-Laurel deposits has been just acquired and prospecting is now in progress. The company's grinding plant at Cane Branch, N. C., was expanded by addition to the grinding equipment and its output raised.

The Carolina Mineral Products Co. is reported to have added a new crushing unit at its mine and plant at Greenville, S. C. The entire output of the plant is sold in crude form to grinding companies. Herbert P. Margerum, who about three years ago purchased the holdings of Golding Sons Co., operating mines in Maine, Connecticut, Maryland and North Carolina and grinding mills at Trenton, N. J., Erwin, Tenn., and other places, has acquired the mines and properties of the Clinchfield Products Corp., Erwin, Tenn. Among newer developments in the feldspar industry is the survey recently completed by Golding Sons Co. for a hydro-electric plant on their site on the Noliguchy River, near Johnson City, Tenn. The grinding mill operated by the company at Erwin, Tenn., has been increased about 30% by added milling facilities. Several other companies are said to have added to their grinding capacity, among them being the Tennessee Mineral Products Co., Spruce Pine, N. C. A 23-acre deposit of feldspar, suitable for ceramic uses, is reported to have been opened at Chester, Vt. This will make the first commercial deposit to be worked in that state. Of interest to the entire feldspar industry is the reorganization of the Eureka Flint and Spar Co., Trenton, N. J., with a capital of $10,000,000. The corporate name was unchanged. Plans were laid for expanding the present operations, which include several feldspar mines and grinding mills.

Bright Outlook for 1927

All indications point to a very good year for 1927 for the feldspar industry. New



Working a pit for high grade feldspar at Wilton, N. Y.—view at lower right shows feldspar at mill ready for crushing

business is expected from a great many glass manufacturers who have hitherto not used feldspar in their glass. Tests are said to have shown that the addition of feldspar to the batch improves the tensile strength of the glass and adds to its resistance in weathering. In addition to this there are other industries on the point of substituting feldspar for materials now in use. In North Carolina there has been an acute shortage of crude material in the latter part of 1926, and the stocks at the grinding plants are quite low. This will probably cause a great increase in production during the early months of 1927, a time when the industry is ordinarily rather quiet.

Protection Needed for Domestic Spar

The domestic spar comes into competition with Canadian spar, which is imported duty free. There is a duty of $3 a ton on ground spar but this does not apply to the crude. A bill calling for a $3 per ton import tax is now up before the House of Representatives. The transportation of Canadian spar in 1925 amounted to about 15% of the total production in the United States. There is a need of some sort of standard classification for feldspar which should be made according to the amount of free silica. As it stands now, the same grade numbers of feldspar from several producers show wide variations and present confusion to the buyers unless they are familiar with the various companies' products. The adoption of standard grades would allow sorting and mixing of feldspar to be carried out in a more economical manner. The producers should organize some sort of a central body or association for the purpose of drafting the needed standards and further research work on new uses and betterments of the product.

Golding Sons Co. feldspar grinding mill at Erwin, Tenn.

Mica Production Increases in 1926

Mica is one of the few rock products production of which is not sufficient to supply the domestic consumption. In fact the imports are over twice the production. Production is confined chiefly to 12 states, North Carolina and New Hampshire being the principal producers. It has been argued that a protective tariff on mica would encourage many other smaller deposits to be worked and thus greatly increase the total production, but this is open to question. A definite need, says one producer, is better control of mine run and plate mica shipments. This could be done, he says, by having an expert mica sampler to examine the shipments as they arrive at the point of destination and definitely fix their value and quality. A better understanding between producer and buyer would result and mutual advantages be obtained. A new company, the Micolithic Co., Houston, Tex., is reported to have under development a large deposit of mica near Collado. According to reports, the company is said to be planning the erection of a large crushing and cutting plant. If these reports are true, Texas will soon rank as one of the leading mica producers in the United States.

Great Activity in North Carolina

Indications are that the production of mica was increased in 1926 for reports from North Carolina, one of the largest producing states, show a greater activity than in the past years. New uses developed for the product were very few; the outstanding one being that developed by the General Electric Co. As outlined by the company, the process consists of combining lead borate and ground mica to form a new insulating material called Mycalex. Its chief use is in places where high frequency currents are encountered, as in radio work. The compound has very desirable properties, such as softening under heating, becoming sufficiently plastic to allow molding under pressure. Metal parts can be combined with it during the molding and then the rough mold machined as desired. The electrical properties are said to be superior to porcelain in many respects. It has interesting possibilities and offers an attractive market to producers of off-color or otherwise imperfect mica.

Importations of Feldspar

A CONSIDERABLE part of the supply of feldspar annually available for the ceramic and other feldspar-consuming industries in the United States is mined in Canada, states the Bureau of Mines, Department of Commerce. According to reports of the Dominion Bureau of Statistics, the Canadian shipments—all from Ontario and Quebec—amounted in 1925 to 23,189 long tons, valued at $214,479, or $9.25 a ton, a decrease of 42% in quantity and 40% in value compared with 1924. The sales of Canadian spar ground in the United States in 1925 constituted 13% of all ground spar sold in this country in that year, a proportion about the same as that for several years preceding.

Besides the United States and Canada, Germany, Norway and Sweden are the chief producers of feldspar. Although the United Kingdom has an immense pottery industry, it appears to be a small producer of feldspar. Cornwall stone rather than feldspar is extensively used as a flux in the British pottery industry.

Probably all the feldspar consumed industrially, except that used for facing cement work, for covering prepared roofing, for "chicken grits" and like purposes, is prepared by fine grinding. Even for such uses the spar is at least crushed to small sizes and more or less graded by screening.

Further details regarding the feldspar industry in this country and abroad are contained in the Bureau of Mines publication, "Feldspar in 1925," by Jefferson Middleton, which may be obtained from the Superintendent of Documents, Washington, D. C., at a price of 5 cents.

Graphite

NATURAL graphite is used chiefly in the manufacture of foundry facings, pigments and paints, crucibles, pencils and crayons and commutator brushes, states the Bureau of Mines, Department of Commerce, in a recently issued report. As the result of an investigation by the United States Tariff Commission, it was found that, contrary to general opinion, the use of graphite in the manufacture of crucibles is comparatively small. Only 15% of the consumption for finished products went to this use in 1923 and 13% in 1924. Foundry facings consumed the largest proportion—44% in 1923 and 52% in 1924. Pigments and paints were second in the quantity of graphite consumed—16% in 1923 and 18% in 1924. The manufacturers of pencils and crayons and of commutator brushes ranked fourth and fifth as consumers of graphite, each taking 9% in 1923 and 5% in 1924. These five products used 91% of the total in 1923 and 93% of it in 1924. Only three uses, all minor, showed increases in 1924 as compared with 1923. Graphite for bearings and bushings and for lubricants commands the highest prices for the commodity.

Reducing the Moisture Content of Portland Cement Slurry by Filtration

One of the Most Notable Developments in Wet-Process Cement Manufacture

By D. C. Coulson
United Filters Corp., Hazleton, Penn.

THE last few years have seen a marked increase in number of wet-process cement plants built in preference to the dry-process plants in spite of the increased cost of kiln operation. The advantages and disadvantages of the wet process over the dry process are well known. The disadvantages are greater kiln size for the same capacity and greater fuel consumption per barrel of cement due to the necessity of evaporating the moisture contained in the wet slurry fed to the kiln. Attempts have been made for a number of years to find a practical method for reducing the moisture in the slurry introduced into the kilns, but due to the space required for installation of equipment, high first cost, and feeding of caked slurry to the kiln, no progress was made.

The United Filters Corporation, realizing the possibilities in the reduction of moisture in wet-process cement plants, have for the last four or five years been devoting a good deal of time and research work to the solution of this problem, and the first practical installation of continuous filters for feeding cement kilns was made in August, 1925, at the cement plant of the Ford Motor Co., Fordson, Mich. The practical and successful operation of the American continuous filters at this plant has already attracted widespread interest.

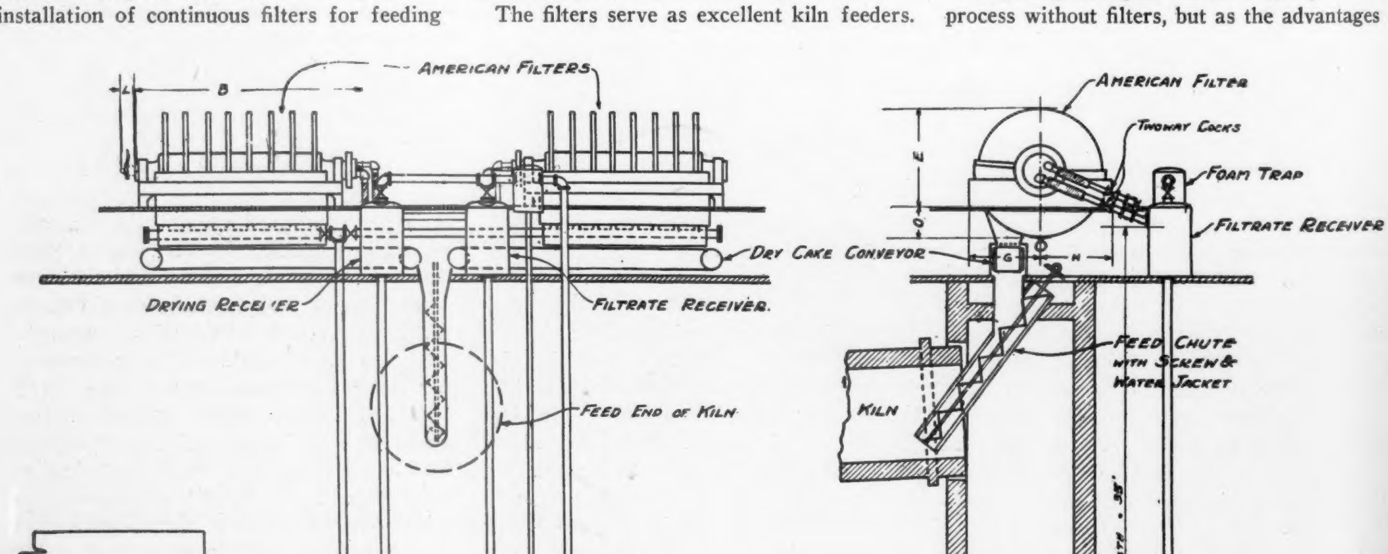
Cement is made at the Ford plant in two 10-ft. by 150 ft. kilns utilizing blast furnace slag from their own blast furnaces. The molten slag, quenched with water, is pumped to storage bins and fed with limestone to a standard wet Compeb mill.

The usual pumps, Dorr agitators and correction tanks are used. From the bottom of the correction tank the slurry, which ranges from 35 to 45% moisture, is pumped to the two filters located directly over the feed end of the kilns. The filters dewater the slurry and discharge it into the kiln in cake form through an inclined water-jacketed chute in which a feed screw is operating. The filter cake moistures run between 16 and 19%, whereas formerly 33% was the lowest practical operating moisture for liquid slurry.

The filters serve as excellent kiln feeders. The amount of filter cake fed to the kiln is controlled by regulating the rotation speed of the filter. The cake has no tendency toward balling or forming mud rings but breaks up in the kiln as damp sand would. Its physical condition is ideal for transfer of moisture to the surrounding kiln gases. Serious mud rings and balling difficulties formerly encountered were entirely eliminated by the use of filter cake, and brick lining has replaced the usual iron plate linings and lifters.

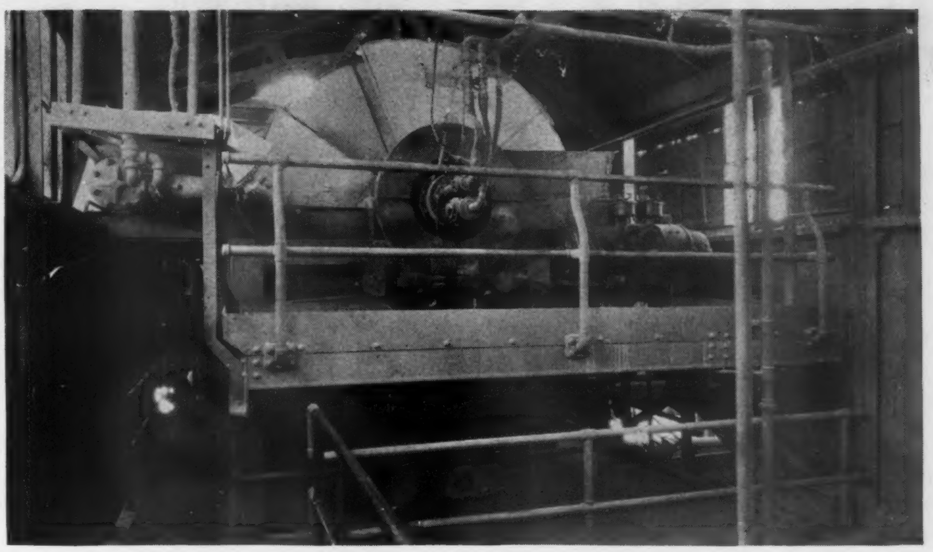
It is interesting to note that the quantity of dust coming from the stack is no greater when operating on filter cake than formerly on 33% moisture slurry. This feature is important, for the wet process had been installed in an effort to cut down the dust conditions which accompany the manufacture of cement by the dry process. The cement plant is located in the midst of the Ford Motor Co. buildings, and the dust nuisance could not be tolerated.

Originally the plant used a straight wet process without filters, but as the advantages



Front and side elevation of an arrangement for the continuous filtering of cement slurry

to be derived from a filter installation were visualized, the Ford management installed their first filter over the No. 2 kiln in place of the standard bucket feeder. Operation started in August, 1925. After four months of operation, the results were so satisfactory that they decided to install another unit above their No. 1 kiln. Just prior to the installation of the filter over the No. 2 kiln, careful records were taken for comparison and, through the courtesy of the Ford Motor Co., the results of the operation are listed in Table I given below. Both kilns of the same size were operated identically except that No. 1 kiln was fed liquid slurry containing 33 to 35% moisture, and No. 2 kiln was fed filter cake containing from 16 to 19% moisture. The comparative records were taken over a period of a month during which time both kilns were in continuous service, and after the cement plant had been in operation for nearly two years.



Cement slurry filter at Ford Motor Co.'s cement plant

In figuring coal consumption, no credit is taken for steam produced in the waste-heat boilers. No. 2 kiln using 24.39% less fuel per barrel of clinker produced 7.43% more steam than No. 1 kiln, because of the higher temperature of gases leaving the kiln.

Each of the kilns operating on filter cake feed are now delivering as high as 1600 bbl. of clinker per day and recently averaged 1425 bbl. per day over a 21-day period. The maximum production per day when the kilns were operated on liquid slurry was 1100 bbl. and average about 1000 bbl.

No. 2 kiln was started up cold and later in the month was operated at approximately half capacity for 48 hours while the cooler was being relined.

Slurry Mixture

The raw mix at the Ford plant is made up of approximately 60% limestone and 40% blast furnace slag. The slag has already been calcined in the blast furnace and contains approximately 45% CaO. This accounts for the low wet-process figure of 112.35 lb. of coal per bbl. of clinker on the unfiltered slurry and a correspondingly low figure on the filter cake feed.

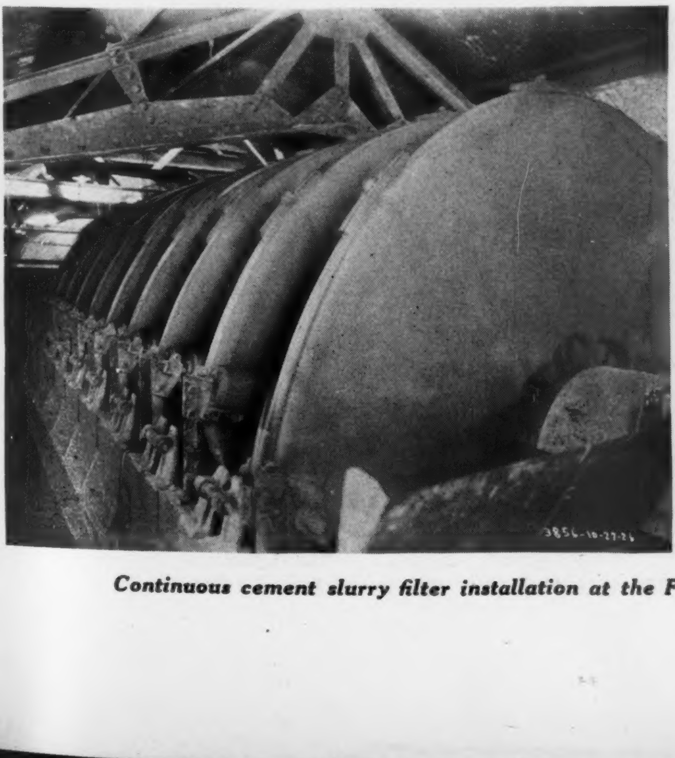
The operation of the feed end of a wet-process kiln, whether it be burning liquid slurry or filter cake, is that of a direct-heat dryer. In normal dryer practice one pound of coal evaporates 5 to 6 lb. of water. In reducing the slurry moistures from 33 to 17%, the filter kept 144 lb. of water per barrel of clinker out of the kiln, representing a reduction of 57.8% in water fed to the kiln. This resulted in a reduction in coal consumption of 27.39 lb. per barrel of clinker or one pound of coal evaporated 5.2 lb. of water, which checks with dryer practice. The elimination of this water releases kiln capacity for burning additional clinker.

Reducing standard slurry moistures to

TABLE I. COMPARATIVE DATA ON KILNS WITH AND WITHOUT FILTER

	Kiln No. 1 without Filter, January, 1926 (31 days)	Kiln No. 2 with Filter, April, 1926 (30 days)
Size of kilns, in feet	10 x 150	10 x 150
Lb. of 14,000 B.t.u. coal	3,543,600	2,737,600 lb.
Bbl. of clinker produced	31,540	32,220 bbl.
Total pounds of coal fed per barrel of clinker	112.35	84.96 lb.
Saved pounds of coal per barrel of clinker	....	27.39 lb.
Per cent reduction in fuel per barrel	....	24.39%
Bbl. of clinker per day	1,017.4	1,074.0 bbl.
Kiln gas temperature, deg. F.	800	1,200 deg. F.
Lb. steam produced by waste heat boilers	11,440,000	12,579,000 lb.
Lb. steam produced per barrel	363	390 lb.
Per cent increase in steam production per barrel	....	7.43%
Per cent moisture in kiln feed	33-35	17-19%
Lb. of dry raw material per barrel of clinker	507	507 lb.

Powdered coal used in both kilns.



Continuous cement slurry filter installation at the Ford Motor Co.'s cement plant at River Rouge, Mich.

filter cake moistures by use of these filters has been a decided success at the Ford plant and point to a practical step in the reduction of production cost in wet-process plants. In the case of marl and limestone plants, the

Sector covered with cloth filter bag

reduction in the moisture of the kiln feed is of even more importance as shown by the tabulation given in Table II.

Water Removed by Filtration

Tests have shown that it is possible to reduce the moisture in limestone-clay slurries to 18-19% and in marl slurries to 24-28% by filtration, but the percentage of moisture is determined by the character of the slurry. The results given in Table III are prepared from data obtained from representative filter tests on slurries from various cement plants.

These data show clearly that much greater savings in fuel consumption and increased kiln capacity are available in plants using limestone and marl than at the Ford plant. The larger the amount of wet slurry per barrel of clinker the greater the savings.

Cake moistures on these tests range from 16 to 40%, and are dependent solely on the character of the slurry. On the same slurry there is no difference in the *cake moisture* discharged from the filter whether the slurry fed to the filter is 35 or 60% moisture.

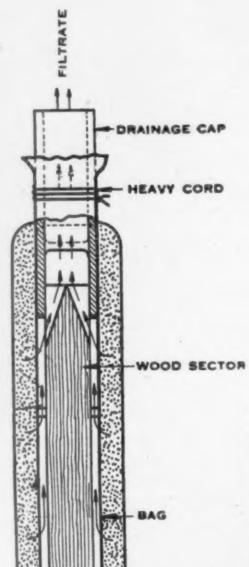
Description of Filters

While the American filters are comparatively new to the cement manufacturers, they have been largely used for years in mining and other large industries. A brief description of their operation may be of interest.

The American filter consists of from one to twenty filter discs assembled around a horizontal cast iron center shaft, mounted on the slurry is fed from the correction tanks. Each disc is subdivided into ten pie-shaped sectors that connect into corresponding conduits running the entire length of the hollow cast iron center shaft. Each conduit drains separately a row of sectors and is connected to a simple rotary type plug valve, mounted on the end of the center shaft.

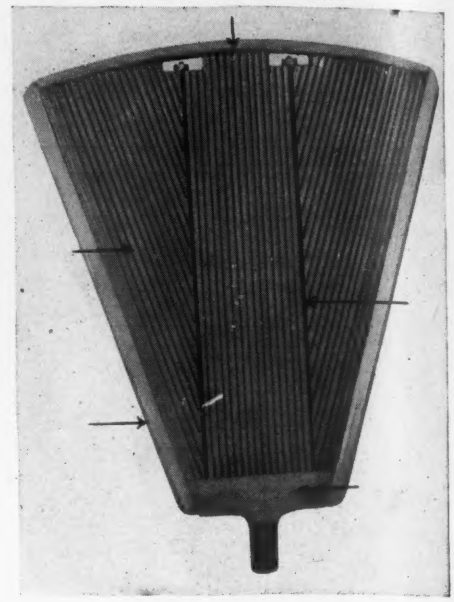
Each sector, or one-tenth of each disc, is an individual unit consisting of a sturdy pie-shaped drainage member incased in a cloth bag. This construction, when assembled, gives a rigid disc with filter surfaces on both sides and permits easy change of filter cloth.

Each row of sectors is separately con-

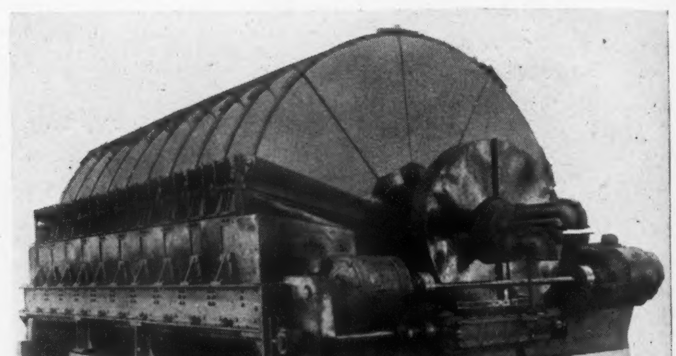


Cross section of sector showing cake

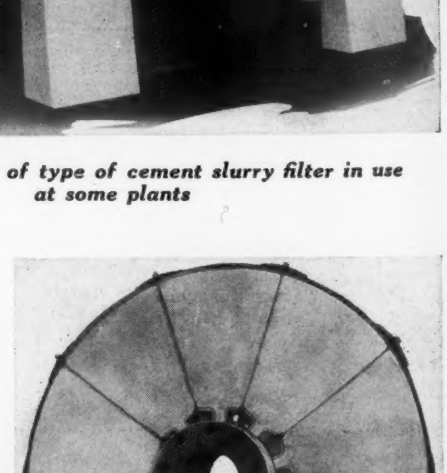
trolled by the filter valve. As they slowly rotate into the slurry, and are submerged, vacuum is applied drawing the water through the cloth and depositing the solids on both outside surfaces of the discs. All the sectors in the submerged half of the discs are continuously building cake. This cake is dried as the discs rotate from submergence through the upper or exposed portion of rotation until each row of sectors reaches the discharge position. Vacuum remains on the in-



Sector of filter disc uncovered to show construction



Assembled view of type of cement slurry filter in use at some plants



Filter disc assembled on shaft section. One sector uncovered to show construction

TABLE II. COMPARATIVE DATA ON FILTRATION OF SLAG, LIMESTONE AND MARL SLURRIES

	Slag Slurry	Limestone Slurry	Marl Slurry
Lbs. per barrel clinker	380	380	380 lb.
Per cent loss weight of dry solids in burning	25%	35%	45%
Lbs. dry solids per pound	507	585	690 lb.
Per cent moisture in liquid slurry	33%	33%	45%
Lbs. liquid slurry per barrel clinker	756	875	1,250 lb.
Per cent moisture in American filter cake	19%	19%	25%
Lbs. filter cake per barrel clinker	626	721	920 lb.
Lbs. water removed by filter per barrel of clinker	130	154	330 lb.
Lbs. water evaporated per pound of 14,000 B.t.u. coal in dryer practice	5.4	5.4	5.4 lb.
Lbs. fuel saving per barrel due to removing moisture	24.1	27.6	61.0 lb.

TABLE III. RESULTS OF FILTER TESTS ON CEMENT SLURRIES FROM VARIOUS PLANTS

Plant No.	Material	Lb. Raw Material Per Bbl. (Dry)	Per Cent Moisture in Liquid Slurry	Lb. Liquid Slurry Per Bbl. Clinker	Per Cent Moisture Filter Cake	Lb. Filter Cake Per Bbl. Clinker	Lb. Water Removed by Filter Per Bbl. Clinker	Per Cent Total Water Removed
1	Limestone clay	600	33	897	18.6	738	159	53.6
2	Limestone clay	570	37.5	913	24.8	758	155	45.2
3	Limestone clay	600	42.5	1,045	28.0	834	211	47.4
4	Limestone clay	586	36.4	921	18.7	719	202	60.2
5	Limestone clay	620	43.0	1,085	18.7	764	321	69.0
6	Limestone clay	630	34.0	955	18.0	769	186	57.1
7	Limestone clay	630	33.9	952	16.2	752	200	62.2
8	Limestone clay	600	37	955	20	750	205	57.8
9	Marl	700	65	2,000	40	1,165	835	64.4
10	Limestone clay	630	30	906	17	760	146	52.9
11	Marl clay	740	46	1,370	26.4	1,002	368	58.5
12	Limestone clay	620	33	926	18.8	764	162	53.0
13	Slag	507	33	758	17	613	145	57.7

side of the discs through the cake building and drying part of the cycle. The filter valve cuts off the vacuum as each row of sectors pass the dischargers and introduces very low pressure air, releasing the vacuum and discharging the solids, or cake, vertically through crenelations in the filter tank. From there the cake passes to the kiln just below the filter.

The water and the air used for drying the cake are both discharged from the filter valve and pass through piping to receiver tanks where the air and water are separated. The water drains from the receivers through barometric legs and the air is withdrawn from the top of the receivers by dry vacuum pumps.

The filter discs are rotated slowly, from five to fifteen minutes per revolution, by means of a cut worm and gear directly driven by a variable speed motor, all mounted on a single cast iron end frame.

Replacement of filter bags on the sectors is easily accomplished by loosening only two nuts on the radial rods, lifting out the sectors and replacing them with an extra sector. The Ford operators change the sectors without stopping the rotation of the filter.

Research Projects at University of Maine

FOLLOWING is a list of the research work being conducted at the Highway Testing Laboratory of the University of Maine:

1. Abrasion Test for Portland Cement Mortars.

2. A Study of the Effect of Mica on the Strength of Mortars.

3. A Study of the Effect of Crusher Dust on the Strength of Sands.

4. A Study of the Accuracy of Check Tests upon Sand Mortars in Tension and in Compression.

5. A Correlation Study of the Effect of the Size of the Sand Particles upon Mortar Strength in Tension and in Compression.

6. A Study of a 2-in. Cube as a Substitute Specimen for Tension and Compression Tests of Cement and Sand Mortars.—*Highway Research News.*

Dust Losses from Wet and Dry Process Cement Kilns

By Evald Anderson
Western Precipitation Co., Los Angeles, Calif.

IN a recent issue of ROCK PRODUCTS (November 27, 1926, page 88), D. C. Findlay, in his review of the latest edition of Richard K. Meade's book on portland cement, discusses the dust losses from wet process cement kilns and suggests that this question of dust losses is decidedly controversial. It is undoubtedly true that everything else being equal, such as gas velocities in the kiln, nature of the raw material, etc., there should be, and undoubtedly is, a smaller percentage of dust loss from a wet-process kiln. This is particularly true if precautions be taken to present a large surface of wet slurry to the gases, as, for example, by means of lifters in the feed end of the kiln.

Mr. Findlay cites various cases where changing a mill from a dry process to a wet process apparently caused very great lowering of the dust fall from the kiln stacks. It is, however, not always safe to depend on visual observation in judging dust losses, for often a change in the kilns and stacks may change the distribution of the dust fall on the surrounding landscape without materially changing the actual amounts. Moreover it should be remembered that in coal-fired kilns there will ordinarily be produced from 7 to 30 lb. of very finely divided coal ash per barrel of clinker. When it is remembered that the coal is usually first ground to a fineness so that the average particle is smaller than 200-mesh material and that the coal ash particles must in each case be a small residue of these coal particles, it is evident that these coal ash particles must be exceedingly fine. Such fume-like material is not easily collected by means of impact on wet surfaces, such as particles of wet slurry.

In view of this discussion, the following data on actual dust losses from the stacks of wet and dry process coal fired kilns may be of interest:

Dust Losses from Coal-Fired Cement Kilns

Wet process kilns Plant No.	Size of kilns	Dust loss in lb. per bbl.
1	6½ ft. x 78 ft.	40 lb.
2	7½ ft. x 125 ft.	50 lb.
3	8 ft. x 125 ft.	20 lb.
4	10 ft. x 175 ft.	55 lb.
5	9 ft. x 200 ft.	45 lb.

Dry Process kilns Plant No.	Size of kilns	Dust loss in lb. per bbl.
1	7 ft. x 110 ft.	25 lb.
2	8 ft. x 125 ft.	34 lb.
3	10 ft. x 150 ft.	53 lb.
4	7 ft. x 180 ft.	32 lb.

It is evident from the above table that the dust losses from either wet or dry process cement kilns are decidedly variable quantities which depend on a number of factors, so that no hard and fast rule can be laid down.

Specifications for Calcium Chloride in Concrete

THE Solvay Process Co., New York, has recently issued a bulletin covering the proportions of calcium chloride which are to be added to portland cement concrete for cold weather work. The specifications follow:

A standard solution of 4 lb. of calcium chloride to the gallon is advisable. In adding the solution to the cement, it must be figured as part of the mixing water in computing the water-cement ratio. In rich mixes or warm weather, 1 lb. of calcium chloride to the bag of cement is deemed sufficient; this amount may be increased for accelerator purposes to 2 lb. or slightly more. For non-freezing purposes, up to 4 lb. of calcium chloride to the bag of cement can be used. The solution should be added just before or as a part of gaging water, and after being placed in the mixing drum, should be thoroughly mixed to insure uniform distribution throughout the concrete mix.

Recent Developments in Storage Handling

By Louis McLouth
Sauerman Bros., Inc., Chicago, Ill.

AN outstanding operating improvement of 1926 at many sand, gravel, crushed stone plants, cement and gypsum mills, has been the enlargement of storage facilities to enable the plants to cope successfully with seasonal demand and maintain a steady working schedule regardless of fluctuations in orders.

The machine that has given these plants an opportunity, long sought, of storing large quantities of materials at low cost, is the power drag scraper. For this equipment has large capacity, is adaptable to a vacant ground area of any shape or topography and is economical both in first cost and operating cost. The first and last items are particularly important to operators who are storing relatively low priced products for future sale in a highly competitive market.

Capital cost of a power drag scraper installation is low because of the simplicity of the equipment and the absence of complicated mechanisms and elaborate structures. Operating cost is low because the equipment is operated by one man and does not consume much power. Maintenance expense, too, is reasonable, the principal item of replacement being merely the wire rope.

A further conspicuous advantage of this storage system is that it makes full use of all the area available for storage and also is able to recover all the material placed into storage.

Crushed Rock Handling at Cement Plant

One of the best of the year's examples of how use of power drag scraper permits a plant to increase storage facilities many-fold at moderate expense, is offered by an installation for handling crushed rock, made during the summer by the Aetna Portland Cement Co., Bay City, Mich. The mill is located on the Saginaw river and the crushed stone which is used in the manufacture of cement is received by water, three boats being kept busy steadily in this service during the navigation season.

For a number of years the unloading facilities at this plant have consisted of two Brownhoist dock cranes, operating clamshell buckets for unloading the cargoes and putting the stone on the docks. A traveling crane operating over a runway 90 ft. wide and 300 ft. long, took the rock away from the dock cranes, and put it into storage beneath the crane runway, or delivered it into silos alongside the mill. This provided for about 24,000 tons of rock in storage.

The output of the mill has gradually increased and at the beginning of this year it was evident that the crane could no longer handle storage and maintain an adequate supply of rock to the mill. The situation called for additional handling equipment and a larger storage area. The management became actively interested in finding the most economical and satisfactory means of storing between 100,000 and 120,000 tons of stone at a rate of 200 tons per hour, the area available for storage being the space in the crane runway and a strip about 250 ft. wide, parallel to the crane runway.

Several types of material-handling equipment were considered for the project and the power drag scraper was the final choice of the engineers, not only because of its lower first cost and operating economy, but also because it could be installed and in operation quickly.

The ground conditions were unsuitable for

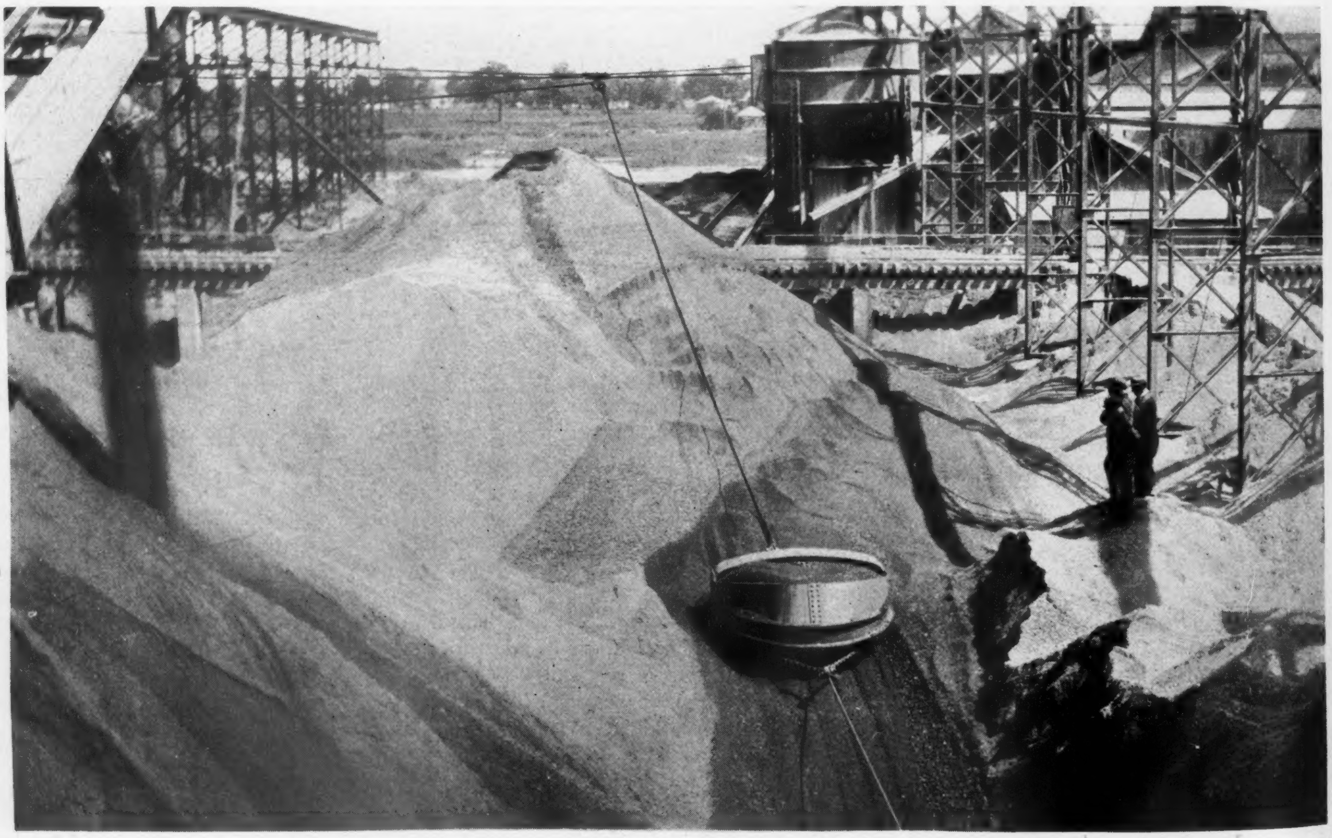


Fig. 1. Power drag scraper piling crushed rock in the crane runway at the Bay City, Mich., plant of the Aetna Portland Cement Co.

the installation of any equipment requiring heavy structures or foundations. The ground is "made land" and very soft and marshy. For these reasons, the installation of other types of machinery would have been very expensive and would have required a considerable amount of time, although it was highly desirable to have the plant in opera-

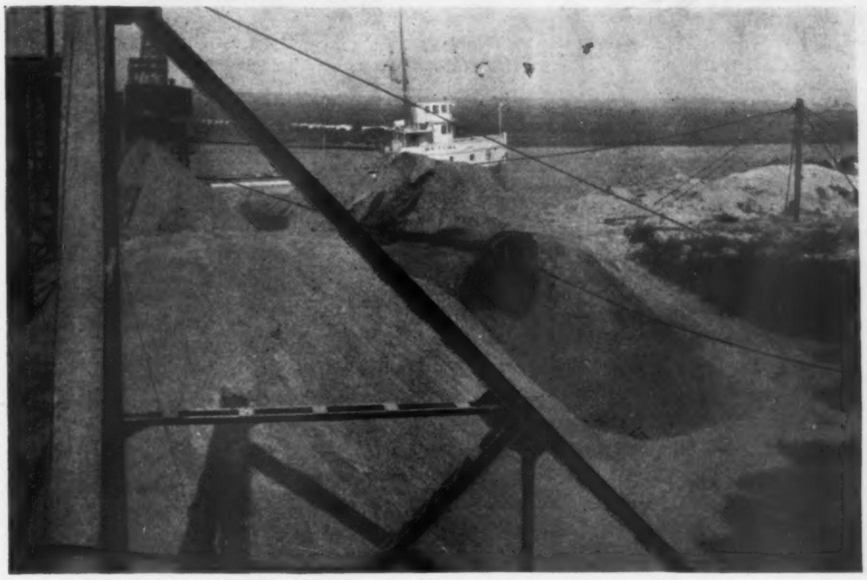


Fig. 2. Scraper storing rock on ground area outside crane runway at a cement mill

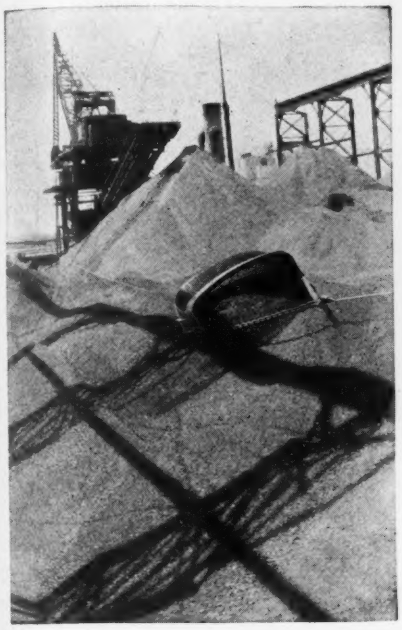


Fig. 3. Scraper removing material from a dock crane

tion at as early a date as possible.

The 3-cu. yd. Sauerman power drag scraper system which was installed has met all requirements perfectly. The scraper can be operated in the old crane runway, or in the area outside the crane runway, as required. Material is taken away from the Brownhoist dock cranes, and placed into storage as fast as the two dock cranes can unload the boats. It was thought best to retain the crane in service over the entire crane runway area, and to employ it for taking material from the one end of the storage yard into the silos at the mill. There is no interference between the operation of the drag scraper and the clamshell bucket on the crane.

Of the total quantity of stone which can be stored, that is, 100,000 to 120,000 tons, approximately 24,000 tons is stored under the crane runway. The balance of it is stored outside the crane runway, and then

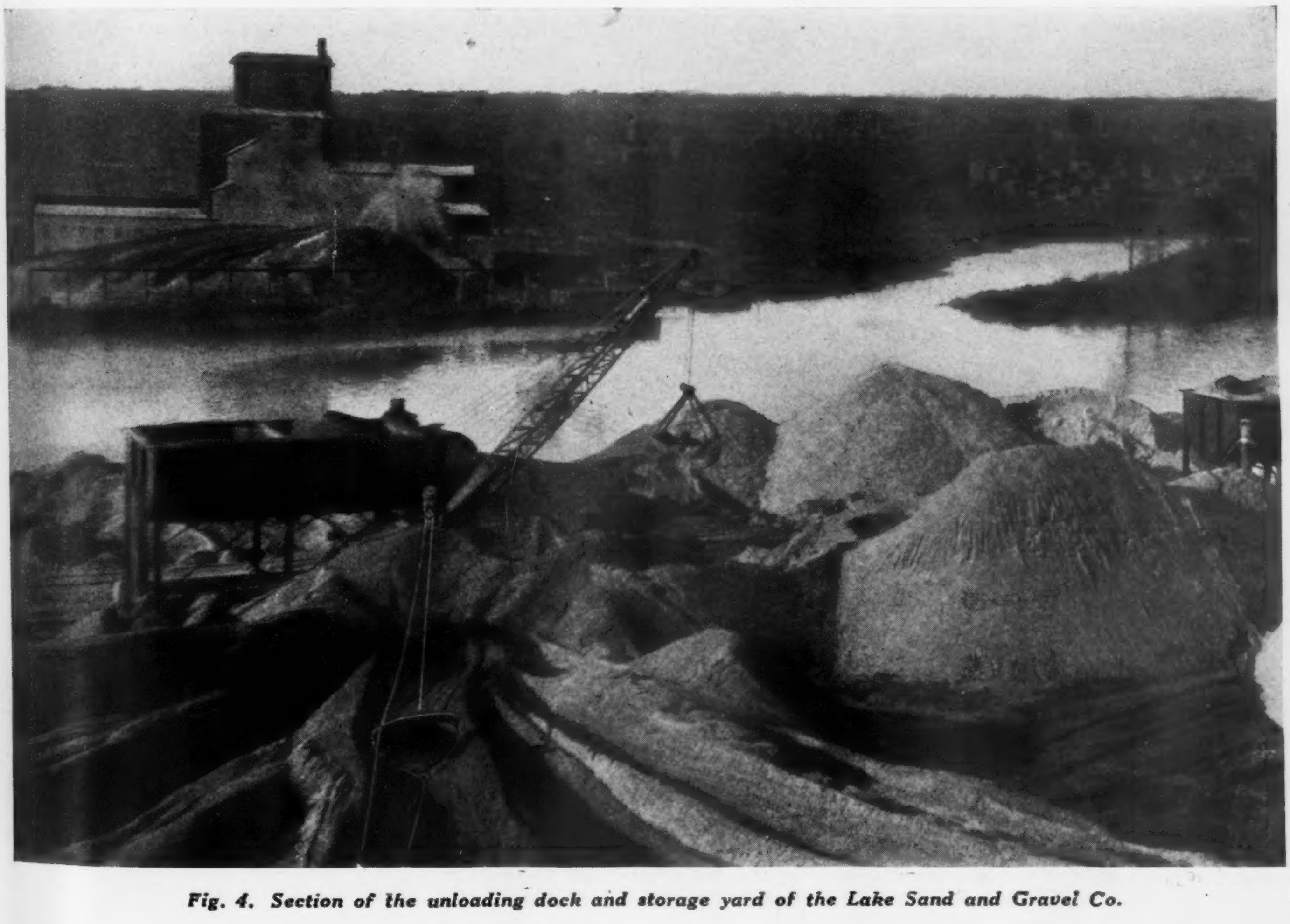


Fig. 4. Section of the unloading dock and storage yard of the Lake Sand and Gravel Co.

reclaimed by the scraper equipment to a point where it can be reached by the crane.

The scraper hoist house is set at the end of the storage area opposite the docks, and is alongside one of the crane runways. The operator's cab is about 32 ft. high, so that the operator can see the entire storage area at all times, and consequently observe the scraper bucket throughout practically all of its operation.

Fair lead blocks in front of the hoist are mounted on a self-supporting steel head post, about 50 ft. high. This head post is set on concrete footings of ample size to distribute the load over the soft ground. At both ends of the crane runway the structural steel bents supporting the craneway were reinforced with additional steel and concrete footings, to support a heavy bridle cable stretched across the crane runway. On these bridle cables are mounted two-wheel carriers, which can be moved back and forth across the bridle cable by means of hand power winches bolted to the steel work. These carriers support the necessary guide blocks for directing the line of operation of the scraper bucket.

At each of the two corners of the storage area which were outside of the craneway there was erected a 40-ft. timber mast, properly guyed to concrete anchors placed in the soft ground. These masts were used to support additional elevated bridle cables which were stretched between the crane runway and the masts, and also between the two masts, thus encircling the storage area with elevated bridle cables, along which could be moved the carriers which supported the necessary guide blocks. The operating cables which pull the scraper bucket back and forth over the pile can be run through these guide blocks in whatever direction may be required by the operation.

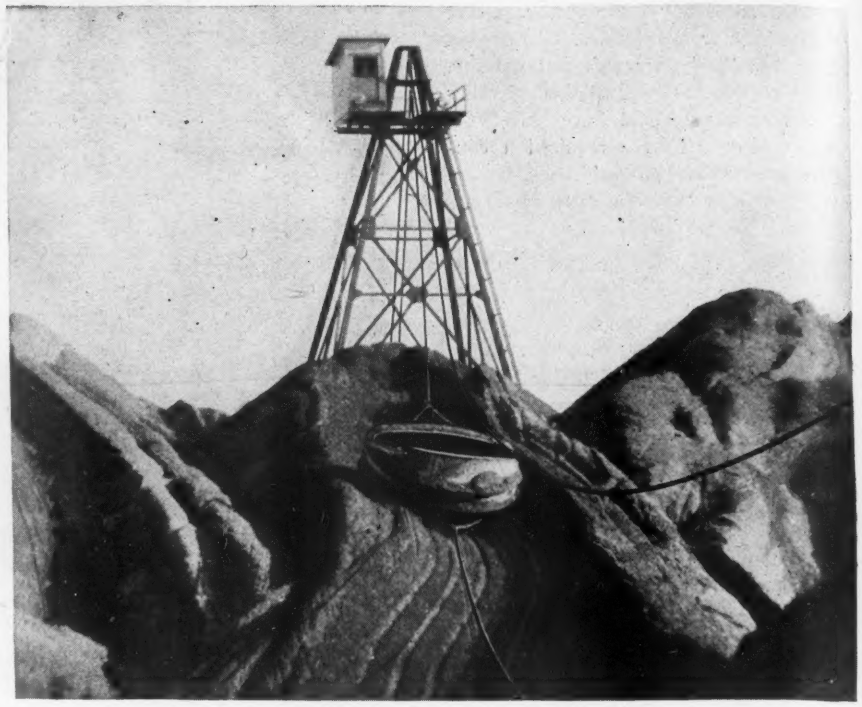


Fig. 5. Movable steel head tower which forms part of the storage system at the River Rouge plant

The equipment was installed in June, and before the close of navigation had placed the required tonnage of rock into storage, as well as having handled the majority of the stone which was taken into the mill.

Sand and Gravel Installation

An interesting variation of the scraper system of storage is found at the dock and storage yard established a few months ago by the Lake Sand and Gravel Co. of Detroit, Mich., on the River Rouge. Five different sizes of material are received at this dock and must be placed in separate piles ranged across the yard adjoining the dock, which is 700 ft. long.

To take care of five separate piles, both in storing and reclaiming, seems like quite a task for a single scraper, but it is accomplished satisfactorily by a mobile installation shown in Figs. 5 and 6. The hoist is mounted on a self-propelled head tower and as the shifting of the tail-end of the system requires only the movement of a snatch-block from one post to another, there is very little time lost in changing the scraper from pile to pile.

The company owns three boats that bring the material in from Lake Erie. Every day during the navigation season at least one boat arrives at the River Rouge dock with a cargo of from 1000 to 2500 tons of sand or gravel, which it discharges onto one of five piles along the edge of the dock. Each pile contains a different size of material and near each pile is a steel truck-loading bin of 120-ton capacity. A track runs between the bins and the shore piles and two cranes

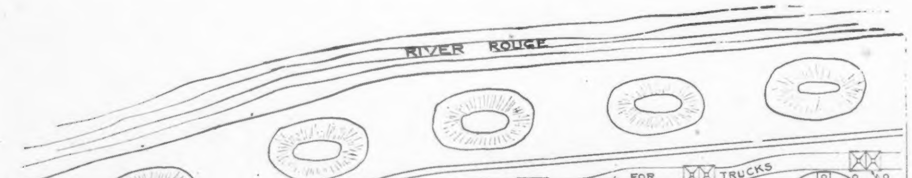


Fig. 6. Plan and elevator of storage system at the Lake Sand and Gravel Co. plant on the River Rouge, Michigan

equipped with 1 and 1½-yd. clamshell buckets are operated on this track to rehandle the material into these bins.

There is always more material coming in than is needed to keep the bins filled, and this surplus, sometimes only a few hundred tons but at other times running as high as 2000 tons per day, is drawn away from the bins by the power drag scraper and placed in long piles that rise to a height of 45 ft.

A 2-cu. yd. Crescent scraper is used to assure a maximum normal capacity, either storing or reclaiming, of 100 cu. yd. per hour. When two boats unload at the dock the same day, the scraper assumes the extra burden by running all night as well as all day, spot lights being provided on the dock to facilitate operations.

Another Sand and Gravel Installation

An installation made this year by the Gordon Sand and Gravel Co., Denver, Colo., at its Clear Creek plant (see Fig. 8) is an example of how a simple application of a power drag scraper enables a producer to deal with a situation that is fairly common in the sand and gravel industry, viz.: an overflow production of several sizes of material at various periods during the season.

The problem at the Clear Creek plant was to arrange storage for 2000 tons of one size of material and about 5000 tons of another size of material on a wedge-shaped ground space extending from the bin structure out to a highway 150 ft. away, the two grades of material to be kept separate and to be stored and reclaimed with the same equipment, which equipment must have a capacity of not less than 30 tons per hour.

This has all been accomplished very easily with a ¾-yd. Crescent power scraper installed as shown in the sketch (Fig. 7) and the required hourly handling capacity exceeded by over 25%.

A wooden bulkhead divides the area into two unequal sections and the two sizes of material are chuted onto opposite sides of this bulkhead from their respective bins. To shift the scraper from one side of the bulkhead to the other, the two front guide blocks of the scraper system are unhooked from their position above one chute and moved to a similar position above the other chute on the opposite side of the dividing wall; the tail-block which is suspended from a carrier running on a cable stretched between two 40-ft. masts at the outer edge of the yard, is then moved along by working a hand-winch located at the foot of one of the masts, and the scraper quickly picked up from one pile and dropped onto the other.

The height at which the tail block is suspended, permits piling material to a natural slope from the plant to the outer boundary of the area, thus maximum use is made of all the storage space.

In reclaiming, the scraper draws the material back to a ground hopper that feeds a bucket elevator rising to the top of the bins. Its reclaiming capacity is 40 cu. yd. per hour.

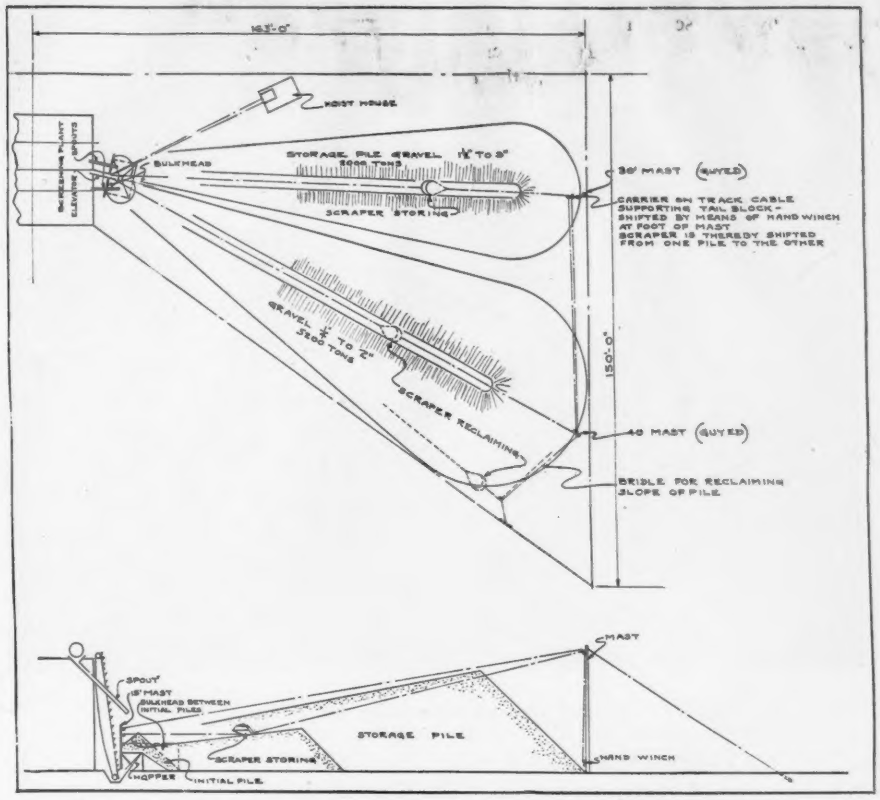


Fig. 7. Layout of storage system at the Clear Creek, Colo., plant of the Gordon Sand and Gravel Co.

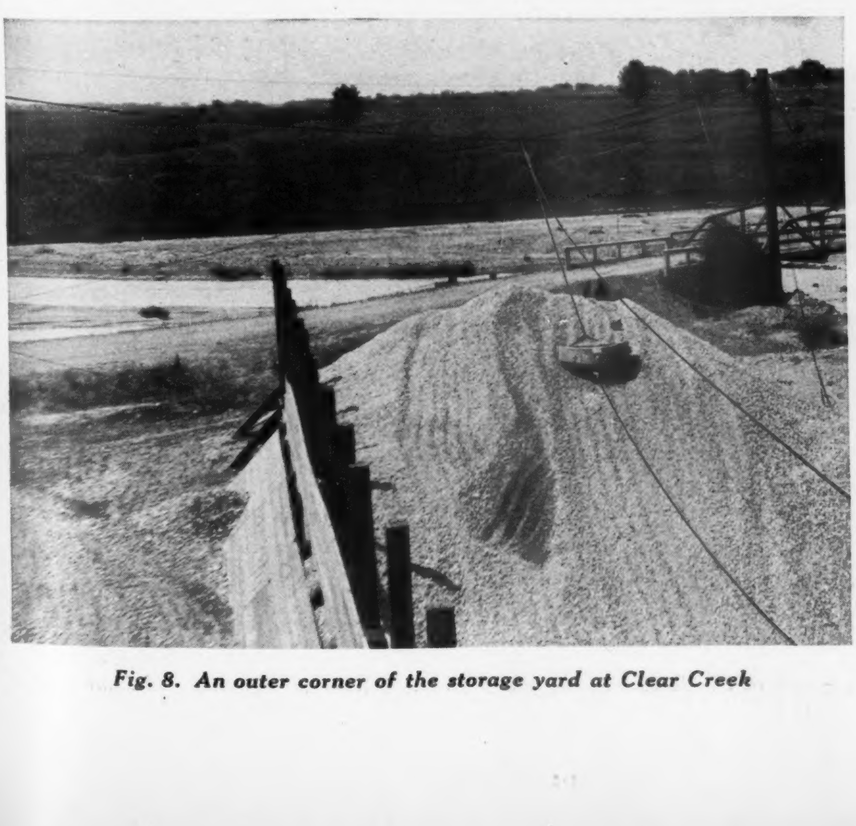


Fig. 8. An outer corner of the storage yard at Clear Creek

For Gypsum Handling

Storage with power drag scrapers is also popular in the gypsum industry. Most of the installations at gypsum mills are for the purpose of augmenting existing outdoor storage facilities of limited capacity.

An installation of this type, at the Iowana mill of the Universal Gypsum and Lime Co. near Fort Dodge, Iowa, is illustrated in Figs. 9 and 10.

An automatic tramway equipped with self-loading and self-dumping cars, brings the crude gypsum rock to the mill from the mine, three-fourths of a mile away across the Des Moines river. The rock is crushed to mill size before leaving the mine.

Originally the only storage for the excess of rock not used immediately in the production of calcined gypsum, was the small space under the tram line structure. The rock stored in this space was recovered through a reclaiming tunnel.

Now the mill, by installing a 50-h.p. electrically operated storage system employing a 1-cu. yd. Crescent power scraper, has increased the original storage many times over,

Fig. 11. Scraper system for storing hot cement clinker

being able to store 25,000 tons of the crushed rock on a strip of ground 200 ft. wide, adjacent to the tram line structure, and this system stocks out or reclaims the rock at the rate of 60 to 65 tons an hour.

The ground utilized for storage slopes from a ridge back of the mill toward a small level area close to the mill site. To store the maximum amount of material on the more level but limited space close to the plant, it was decided to build up a high pile at right angles to the tram line, the scraper stocking the rock from the relatively low initial pile under the tram line toward a guyed mast 80 ft. in height, located about 200 ft. from the tram line (see Fig. 10).

The initial pile is created directly under the tram line at the point of recovery of rock to the mill. The head post is located back of the tram line, and the cables are led to the hoist at approximately 90 deg. with line of scraper operation. The hoist house is located on the top of the ridge back of the plant adjacent to the end of the tram line. With the hoist so located the operation and control of the tram line is taken care of by the hoist operator, and the operator has full view of the scraper operations, as well as extensive view of the tram line over the top of the mill buildings.

The capital invested in the complete installation amounts to only about 25 cents per ton of storage. An analysis of the results of several months' operations with the scraper made by the company's chief engineer, W. H. Crutchfield, showed that capacity was steady, operating and power cost very small, and that all in all it was a cheap operating insurance against mine shut-downs.

The company has since made a similar but smaller installation at its Plymouth mill to handle a 10,000 ton storage.

Cement Clinker Storage

Another use for power drag scrapers is in the storage of clinker at portland cement mills. Figure 11 shows the layout of a small scraper system installed this year at a cement mill at Superior, Ohio, which provides storage for 70,000 barrels of clinker on an irregular strip of ground 300 ft. long lying between the railroad tracks and the mill. The Crescent scraper is of ½-cu. yd. size and the entire layout is simple and inexpensive. It has been found that the steel cables suffer only slightly from their contact with hot clinker.

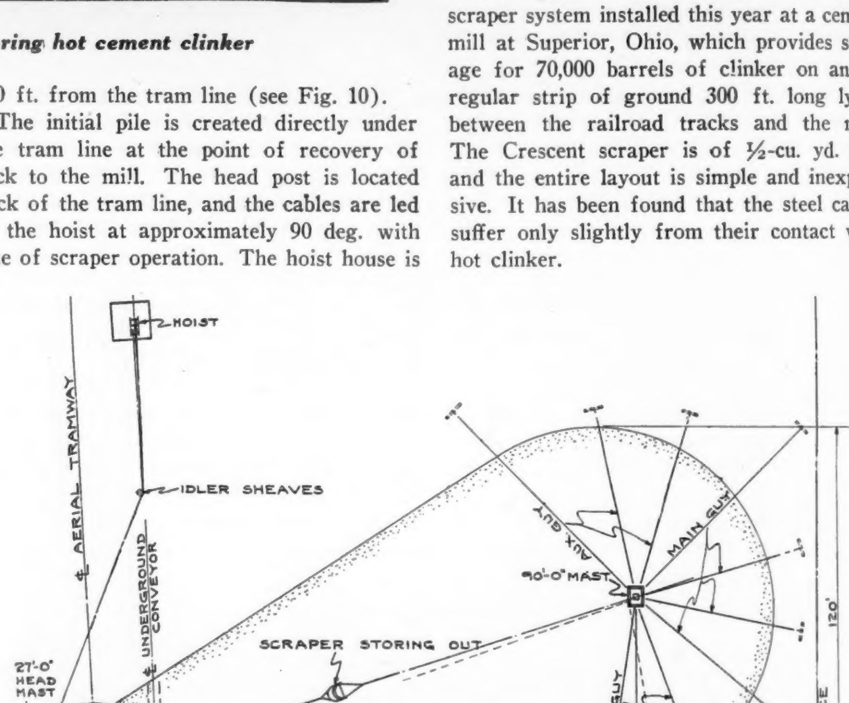


Fig. 10. Plan showing layout of gypsum storage system at the Iowanna mill

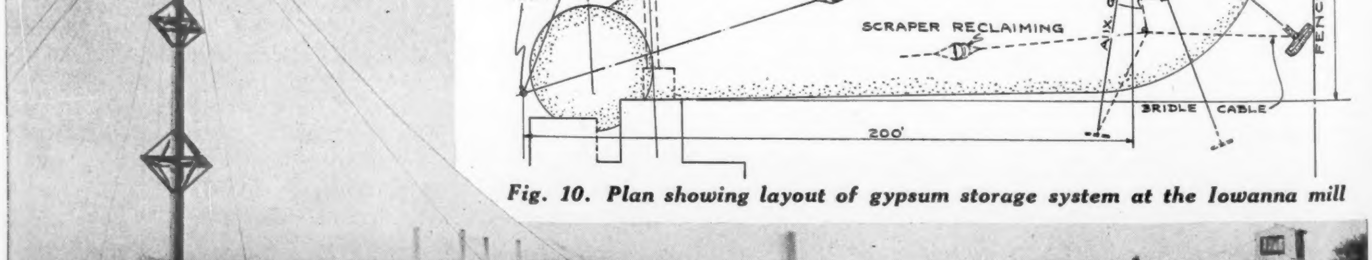


Fig. 9. Drag scraper system for storing gypsum at the Iowanna, Ia., plant of the Universal Gypsum and Lime Co.

New Machinery and Equipment in 1926

A RESUME of developments during the past year in new machinery and equipment designed for producers of rock products follows this page. This summary would not be complete without some reference to the great progress made and now being made in more substantial structures to house rock products operations. Originally looked upon as more or less temporary, such structures in times past have generally been of timber and "tin" construction. Now much such building is done in reinforced concrete, structural steel with galvanized metal, or pure zinc, siding and roofs. In the pages preceding many illustrations of such structures are shown.

In the rock crushing and cement industries the tendency to larger and heavy units continues. The 60-in. gyratory crusher, originally a curiosity, has now at least four "living examples." Compartment tube mills for fine grinding 35 and 40 ft. long are not at all extraordinary. Rotary kilns 340 ft. long are now being installed. Power shovels weighing 200 to 350 tons with 6- to 8-yd. dippers are now not unusual in big quarry operations.

For driving all classes of machinery in rock products plants geared speed transformers are finding a wider and wider application, and special types of transformers are being designed and adapted for this service. Direct motor drives with speed reducers not only make a cleaner, safer and more efficient installation, but permit economies in labor and through standardizing of motors, not thought of a very few years ago. In the following pages we have devoted much space to speed transformers and have shown many illustrations of typical installations in the firm belief that many operators are not yet aware of the numberless ways they may be applied.

Anti-Friction Bearings

Another great step in the line of more economical plant operation is the growing use of ball and roller bearings in machinery and equipment of all kinds. Numerous examples of machinery so equipped will be found in succeeding pages.

Hot bearings are responsible for annual fire losses running well into the millions. No exact statistics are available, but hot bearings are probably responsible for the major part of the losses classified by the Actuarial Bureau of the National Board of Fire Underwriters as "Friction-sparks caused by machinery," averaging some $8,000,000 annually.

Anti-friction bearings consist of an inner and outer ring or race, between which balls or rollers roll on hardened polished surfaces. The inner race is mounted on the rotating shaft and the stationary outer race in a housing. Lubrication is used only to maintain the highly polished surfaces and to decrease wear in the retainers which separate the balls or rollers. Very little lubrication is necessary for this function, and this is decidedly advantageous when certain types of mechanical appliances are considered. For example, it is particularly important in the application of anti-friction bearings to electric motors.

Electric motors are being used more commonly than ever before both in direct connected and in small group drive units. These motors are in many instances located in inaccessible places and lubrication is often neglected. With plain bearings this is particularly dangerous, yet with anti-friction bearings it need scarcely be considered as actual records show that only about one in every 25,000 anti-friction bearings fails because of faulty lubrication. Neglect in lubrication of a plain bearing causes immediate failure; ball and roller bearings run on their initial lubrication six months or even a year without any additional attention. As a matter of fact the manufacturers recommend that anti-friction bearings be lubricated only once every six months since an excess of lubricant causes a churning action in the housing. The oil seal in an anti-friction bearing also serves to keep out all dirt and abrasive dusts, the introduction of which into any bearing will cause rapid wear and loss of efficiency in operation.

With the wear of plain bearings also comes vibration, which in turn causes breakdowns in delicately adjusted machinery, short circuits in electrical units, fires and resulting delay and expense to the industry. Because anti-friction bearings do not wear noticeably, there is very little of this destructive vibration, parts are kept accurately in position as there are none of the strains and vibrations which aggravate unusual wear and destruction of the bearing. A prominent manufacturer of anti-friction bearings has stated that approximately 17% of the electric motors now in service are equipped with ball or roller bearings and that their records show that not one has ever been reported as having caused a motor fire.

At least two manufacturers of frictionless bearings have given rock products operations intensive study during the past year, and elsewhere in this issue will be found some of their most recent developments.

Other things that make for greater efficiency in rock products operations are special refractories for kilns, a growing use of special alloys and materials for machine parts and similar developments.

Dryers and Drying Equipment

THOSE who have read the descriptions of new gypsum products plants, published in ROCK PRODUCTS in 1926 appreciate that great progress has been made in applying expert knowledge of drying to the solution of special problems in this industry. A good example of this is supplied by the Louisville Drying Machinery Co., which built a special type of dryer for the plant of the National Retarder Co., described elsewhere.

This dryer has a cylinder 6 ft. in diameter and steam tubes 35 ft. long. In choosing a dryer for this purpose, the customer, because of the nature of the product, limited the drying temperature to 350 deg., therefore, had he chosen a direct heat dryer, it would have been necessary to mix in large volumes of atmospheric air and, even with a dryer having a cylinder 6 ft. in diameter, the velocities through the machine would have been so great that he would have been compelled to install a costly dust collecting system.

In the steam tube dryer of the National Retarder Co., the drying is not done by air, but solely by the radiant heat from the steam tubes. The air which passes through the machine serves only as a carrier for water vapor and, for this reason, the velocities of the vapors leaving the steam tube dryer are, in the case of the McCook plant, only one-eighth of what they would have been had a fire dryer been chosen and the initial temperature was cut down to 350 deg. at the same time.

Because of the low initial temperature allowable, the installed value of a fire dryer, of equal capacity, would have been considerably higher than the steam tube dryer.

Another installation of a Louisville steam tube dryer is at the plant of the J. B. Ford Co., Wyandotte, Mich. They have a 6-ft. diameter dryer with steam tubes 30 ft. long, which they use for drying volcanic ash or pumice, preparatory to using it as an ingredient in cleansing compounds which they make. The reasons for selecting a steam tube dryer in preference to a fire dryer were exactly the same as in the case of the National Retarder Co. There was in this case, however, an additional reason: The dryer had to be placed in the basement of a large four-story building in which many thousands of dollars of other equipment are also installed, and the installation of the steam tube dryer eliminated the fire hazard, which of course meant a very material reduction in insurance premiums.

These are merely cited as examples of applying expert knowledge of drying to special problems, instead of blindly following precedent. In this regard the gypsum industry is very probably in the lead.

Drilling and Blasting

DURING the year nearly all the compressed-air hammer drill manufacturers have added to their lines of smaller, hand-operated drills, calling them "concrete pavement breakers." These drills are probably too light to be of use in most quarry operations.

The Cleveland Rock Drill Co. brought out a new one of these "paving breakers" during the year. This company also brought out an improvement for all their hammer type drills in the form of an all-steel throttle valve with a "neverloose" handle.

A newcomer among compressed-air drills of real interest to quarry operators, particularly those in settled communities who are finding it difficult to make well-drill shots without arousing the ire of their neighbors, is a wagon drill developed by the Sullivan Machinery Co. during the past year. This device consists of a DW-64 water-jet hammer drill mounted on a framework consisting of steel guides, which enable the drill to have a run, or downward feed, of 15 ft. The framework is mounted on a wagon truck as illustrated in the accompanying view. When being moved from one location to another the framework may be swung back into a practically horizontal position. This drill is particularly recommended for 15 to 30 ft. drilling in limestone quarries, with a 1¼-in. drill steel.

The drill is mounted on a traveling weight, heavy enough to hold the drill to its work. This weight travels the length of the guide tower and a flexible steel cable runs from the drill weight over a sheave at the top of the tower to a small hand winch, which is provided with a hand wheel for releasing the cable slowly and uniformly. A hand crank is provided so that the drill may be quickly lifted out of the hole.

The wagon drill, of course, is not a new type, having been used almost as early as the well-drill type for quarry blasting, and we have described the drills of other manufacturers in previous issues.

Well Drills

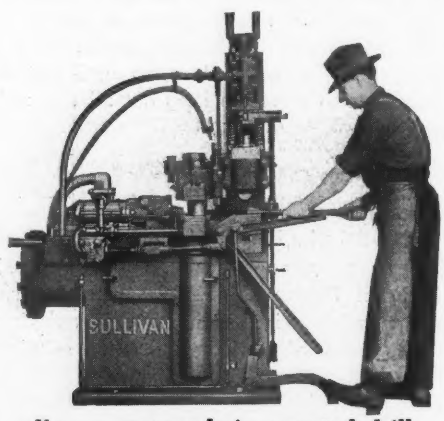
In the well-drill field the Loomis Machine Co., manufacturers of the "Clipper" drill, state that during the year they have produced a drill that not only has roller bearings on the wheels, but the wheels are equipped with rubber tires as well. This company is also making a well-drill mounted on a motor truck. These drills have been used in some small quarries, but their chief distinction is mobility—and this is not so important in most quarry drilling. The crawler type mounting continues to be the most popular for quarry operation.

Drill Sharpeners

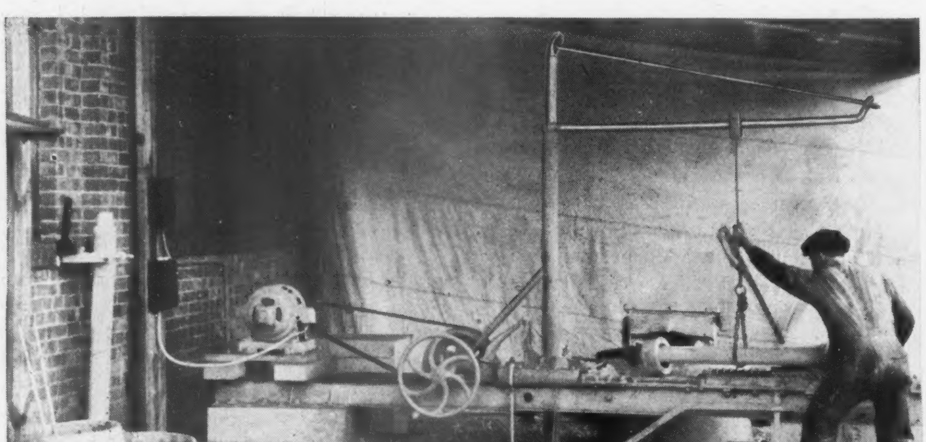
Improvements have been made in drill-sharpening machines. The Sullivan Machinery Co., recently announced its latest type, class "A," an all-hammer compressed air drill sharpener for heavy duty in quarries, mines, or wherever rock drill steel is used. This sharpener consists essentially of a clamp or vise, an upsetting hammer and a swaging hammer, mounted on one compact frame, as shown in the photograph. It is intended for continuous service on bits and steel of all commercial sizes. The machine is said to occupy a floor space of 5 x 2½ ft. Its overall height is 6 ft. and weight is given as 3,800 lb.

The various improvements in this new

One of the latest well drills for quarries



New compressed-air operated drill sharpening machine



Bit sharpener for 8-in. well-drill bits

Wagon drill developed for quarry blasting

machine, as stated by the manufacturers, include a new design of frame which is more compact and lighter than the old one; a new retracting hollow steel punch and new gauging devices for making the double taper bits, now so frequently and effectively used to increase drilling speed.

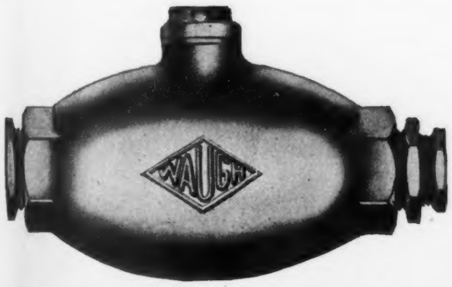
The Sullivan Machinery Co. has also placed on the market a new light sharpener, class "C." This weighs only 1100 lb., and is an all-hammer sharpener, handling ⅞-in. or 1-in. hollow steel, making bits of any desired shape and collar shanks.

Another new product of the Sullivan Machinery Co. is a heavy duty portable core-drilling rig, illustrated below. This drill will give a 2-in. core to a depth of 2000 ft.

For well-drill bits the Armstrong Manufacturing Co. has produced a No. 8 bit-dressing machine to sharpen drill bits up to 8-in. diameter, the largest now in use. It is an exact duplicate of the No. 6 machine, except larger and of greater capacity. It has been demonstrated that a machine-dressed bit drills faster than a hand-dressed bit, and will last longer because the steel is worked uniformly and the grain structure is not injured as in hand-dressing. With the development of the No. 8 this company now has a machine for dressing any size bit from 4 to 8¾-in.

Lubrication of Drills

The lubrication of air drills has received much attention during the year from the Denver Rock Drill Manufacturing Co., which states that it has successfully solved the lubricating problem by developing and perfecting an air line lubricator. Several of the drill models now manufactured by this company are lubricated solely by this method. The results are greater drilling efficiency, prolonged life of all moving parts, and reduced maintenance costs.



Lubricating device for compressed-air drills

The Waugh air line lubricator consists of an egg-shaped, hollow casting, about 5 in. in diameter, and 9 in. long. Within the casting a pendulum arrangement is suspended, which always swings to its lowest position insuring complete utilization of the oil supply. A brass nozzle mounted crosswise in the pendulum feeds the oil into the air stream while the drill is operating by an ingenious arrangement of orifices. The oil is completely atomized as it leaves the nozzle and subsequently bathes all moving parts in the drill with oil-saturated air.

The lubricator is attached to the air hose at a convenient distance from the drill. Its capacity, 1¼ pints, is more than adequate for a full day's drilling. Adjustment is provided to properly control the rate of flow of oil of any viscosity.

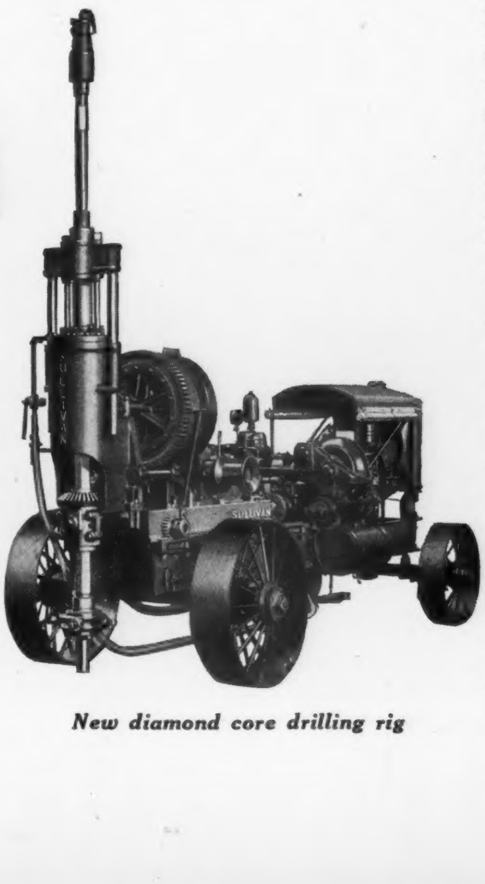
Explosives

N. S. Greensfelder, of the Hercules Powder Co., states: "Such new developments as we have made in the explosive line pertain generally to permissible explosives—those explosives used in coal mines and which are not generally applicable to rock products.

"In the quarrying industry improvements have been more in the line of application of explosives rather than in the explosives themselves. During the year we have been very active in assisting users of explosives to a better understanding of the nature of various explosives in order that better results may be obtained through a selection of the proper explosive, and a proper application of the most suitable explosive."

Excavating and Material Handling

As usual no branch of the rock products industry has shown more progress and life than the manufacturers of shovels, cranes and other material handling equipment. We find that under this classification we have described in the columns of Rock Products during 1926, in chronological order, the Erie Steam Shovel Co.'s new gas-air shovel, in which compressed air, from a gasoline-engine driven compressor, is used for hoist power; the 500-ton shovel on caterpillar treads of the Bucyrus Co.; the Model 75 gasoline shovel of the Thew Shovel Co.; the Bucyrus 3-yd. dipper, 100-B, revolving shovel; the Marion Steam Shovel Co.'s electric shovel especially designed for underground work, requiring only 11 ft. of headroom; the new steering mechanism on the shovels and cranes of the Northwest Engineering Co.; a new underground shovel made by the Nordberg Manufacturing Co.; a new 1-yd. shovel of the Bucyrus Co.; an improved walking device for the large dragline made by the Monighan Machine Co.; the new power shovel of the Star Drilling Co.; especially adapted to stripping overburden; the new electric control of the Westinghouse Electric and Manufacturing Co. on the 1¾-yd. Model 37 Marion shovel; the Bucyrus 41-B, 1¼-yd. model; the Osgood Co.'s new 1¼-yd. shovel; the McMyler-Interstate Co.'s electric shovel with compressed-air operated hoists.



New diamond core drilling rig

A glance through this list shows that a tendency toward better control of gas and electric shovels and a tendency toward making shovels (like men's collars) in ¼ sizes have been outstanding developments. Standard shovels are now made with buckets ½-yd., ¾-yd., 1-yd., 1¼-yd., etc., so that the user has a large choice of sizes from which to select for his particular use.

Tendencies in Shovel Design and Use

Statements eminating from officials of two of the largest shovel builders are interesting in showing the general trend in shovel design, construction and use.

From the Marion Steam Shovel Co., which in October announced a new 1-yd. shovel, comes the following:

"For all practical purposes there is no general utility power shovel outside what is known as the small revolving class with capacities ranging up to 2 cu. yd. That is the range in demand by contractors, and contractors, broadly speaking, are the only users of general purpose shovels. Few general contractors own or want shovels larger than 2 cu. yd. capacity at the outside. The whole thing is merely a matter of economics. Thus contracting shovels fall automatically into a well defined group within what may safely be regarded as an arbitrary capacity limit of 2 yd. or less.

"Beyond this group of contractors' shovels there is practically no field for all-purpose or general utility shovels. Shovels larger than 2 cu. yd. capacity are practically always bought for a specific use. And, because uses for larger shovels are so widely varied, it has brought about the establishment of two distinct types for the various kinds of heavy duty service. These are the heavy revolving type and the railroad type.

"The railroad type shovel is without question by far the more economical and productive on several types of service where the operating radius is restricted and the

material heavy and obstinate. It is impossible to design a revolving shovel to take the place of a railroad type. There are good reasons why, else there would be no railroad type shovels built. One reason is that a revolving shovel, to take the place of a railroad type, must be made so compact as to infringe upon the proper diameter of the roller path, thus sacrificing stability in the face of service which requires the utmost stability. This is something that cannot be overcome by counterbalance for a counterweight heavy enough to impart stability to a small roller path shovel in rock would be too heavy for multi-purpose work. Furthermore, the railroad type shovel has an inherent advantage for close quarters work in its short boom and dipper stick. Due to the shortness of the swing as compared with a revolving shovel of equivalent dipper size, a railroad type shovel is far faster in loading out. A railroad type shovel can rapidly load and swing in quarters so narrow that its cab may be but a few feet from the parallel bank face—it might be against the face for that matter—while manifestly swinging would be impossible for a revolving shovel under those conditions.

"So where the digging is hard and the demands heavy, there is no revolving shovel that can equal or even approach the railroad type.

"But for the much broader range of uses where the operating radius is wide and the face high, in fact in all places where there's 'room for the tail where the head ought to be,' the large square-built, no compromise, revolving shovel is the thing.

"Thus do power shovel manufacturers find it necessary to build three distinct groups of machines—the small revolving group with capacities up to 2 cu. yd., the railroad type in several sizes and the larger revolving group."

New 6-yd. shovel with 3-point mounting

G. A. Morison, second vice-president of the Bucyrus Co., makes this statement:

"A rather noteworthy feature of this year's business has been the great sale of electrically driven shovels and draglines. The company has been manufacturing electrically driven excavating machines ever since the year 1894, but this year's production of machines driven by this power has eclipsed all previous years. We have also had a year which has been marked by a large number of sales of Diesel engine driven equipment. This company originally introduced this type of drive into the field of excavation and this year we have sold more machines of this type of drive than ever before.

"The expansion in the building industry is reflected by the great number of sales of equipment to cement plants and rock quarries. The 120-B and 100-B electric shovels are most popular for commercial quarry work and the 100-B and 50-B electric for cement plant quarries.

"The replacement of caterpillar mounting for old railroad trucks under railroad shovels has continued active so that a large proportion of existing railroad shovels are now or about to be so equipped."

New 6-Yard Shovel

A new 6-yd. shovel, convertible into a dragline, has been just announced by the Bucyrus Co., Milwaukee. This new shovel is called the 200-B and, like the 320-B, is equipped with box-girder boom and outside dipper handles.

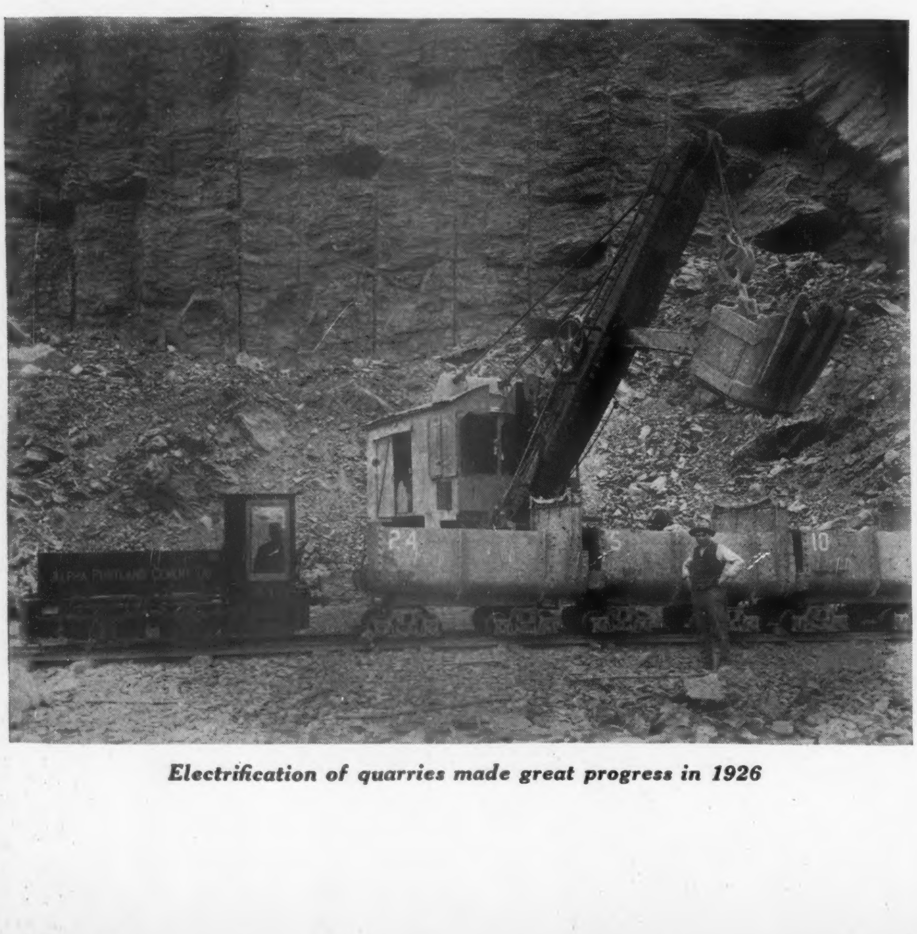
The 200-B is built for faster digging in places where a smaller revolving shovel is not rangy enough and where an 8-yd. shovel is larger than needed.

The type of boom that the new machine uses, it is said, is lighter than a split-boom of equal strength and especially adapted to withstand the severe bonding strains and tortional loads.

This construction is said to permit of operation with less counterweight, which in turn is said to reduce the flywheel effect frequently encountered and therefore allow the shovel to swing fast.

The change from a stripping shovel to a dragline in a 200-B can be made by a few adjustments in the main machinery and a change in the boom equipment. As a dragline the 200-B is constructed to be especially adapted for digging or stripping in the quarrying, phosphate and sand and gravel industries.

The 200-B may be mounted either on four-wheeled trucks or caterpillars, according to what the individual specifications demand. Both types of mountings have three-point supports, which are said to reduce the load



Electrification of quarries made great progress in 1926

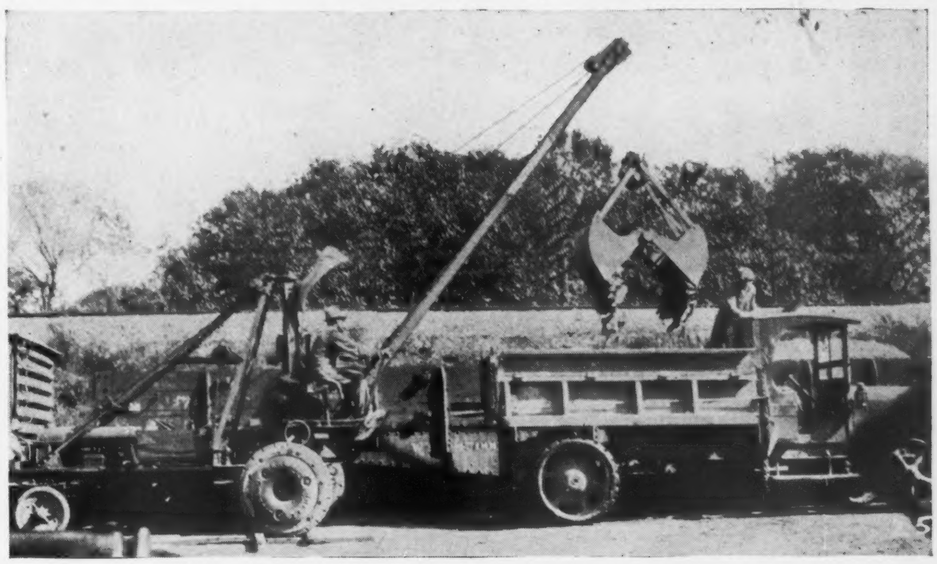
Electric powered shale cutter

Small shovel driven by kerosene-gasoline engine

and wear on the trucks when the loaded dipper swings over the corner of the base.

English Practice

The principal shovel builders outside of the United States, Ruston and Hornsby, Ltd., Lincoln, England, state that their principal developments this year have been the "application of the solid injection vertical oil engine to both shovels and draglines. Straight oil driven sets are being fitted to the smaller sizes, whilst larger sizes are electrically driven by means of an oil engine generating set placed aboard. Another new line is a small ½-cu. yd. machine driven by a gasoline-kerosene engine and mounted on caterpillar tracks. This machine, like all the other small sizes, is convertible for use as shovel, dragline, skimmer scoop, trench excavator, etc., and can be operated by steam engines, electric motors or internal combustion engines."



Crane built about standard tractor units

New dragline or shovel with rugged tread mechanism

New Shovels

At least one newcomer has entered the shovel and crane field in 1926. The American Hoist and Derrick Co., well known manufacturers of hoists, recently announced its "American" Model K gasoline shovel, which is convertible into a pile driver, as well as a crane. It was particularly designed for lumbering operations, and for that reason its continuous chain-tread mechanism is unusually rugged.

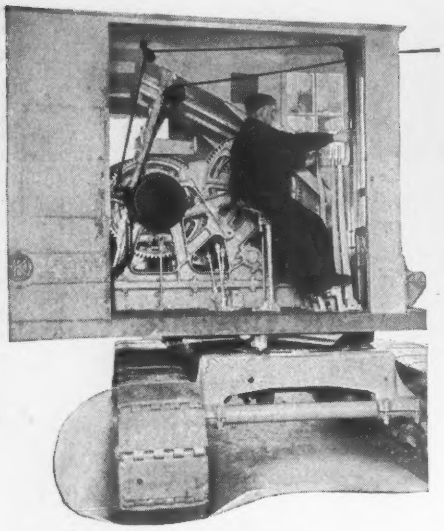
The Star Drilling Co. shovel, described in our issue of July 24, 1926, as particularly adapted to stripping operation, is being used also for loading rock.

New Cranes

A new crane was placed on the market in 1926 by the Vergan Schmidt Co., distributed by Thaleg and Hock. This crane is built about standard tractor units. The wheels are extra heavy for counterweight, equipped with standard motor truck tires. The mast contains the hoisting and swinging mechanism, and a full 180-deg. swing is possible.

The standard boom is 20-ft. centers. The operator rides with the boom, so that he is always facing his bucket or load.

This "Tractocrane" is built in two models, Model "F" uses a Fordson tractor, and Model "I" a McCormick-Deering tractor for the power unit. These models are not intended to replace the big cranes, but to work on the lighter jobs, relieving their big brothers of an immense amount of work which they are continually called upon to do.



Illustrating new "finger tip" control on power shovel

The Browning Co., also, has recently brought out a new truck crane, which is built to the following specifications: Two power drums with outside band friction clutches; two patented automatic brakes; 20 or 30-ft. boom; 45 hp. 4-cylinder Climax engine (Model KU); trolley and track; deep bucket from swing; ¾ steel house bronze bushed throughout; all working parts of forged or cast steel; weight of crane with sub-base ready to mount on truck approximately 12,000 lb.; hoisting speed single line, 5000 lb. load, 150 f.p.m.; hoisting speed two parts of line, 10,000 lb. load, 75 f.pm.; rotating speed up to 3.5 r.p.m.; the dot system of lubrication is used throughout.

New truck crane with centralized control

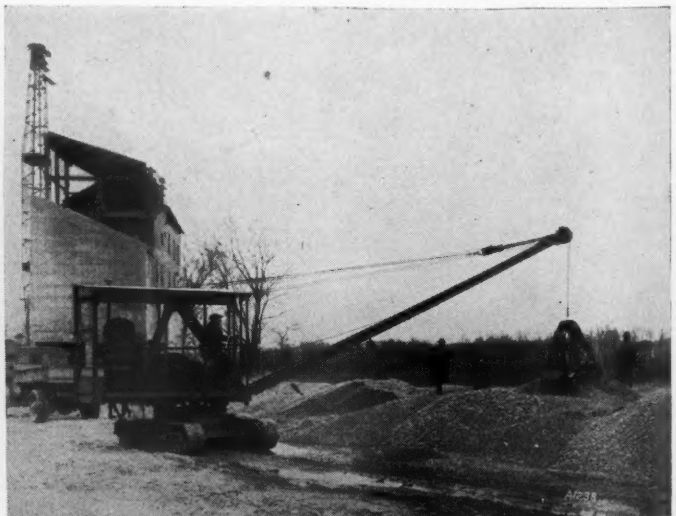
The control of the crane is centralized at the operator's position in the front of the cab so that every control is directly in front and within easy reach of the operator. This system of centralized control has been worked out so that the levers which are used the most are placed in such position as to require the least amount of effort on the part of the operator.

The Meade-Morrison Co. announces that improvements have been made during the year in its small ½-yd. convertible shovel-crane. This was brought out more than a year, but in 1926 the number of attachments were increased to include besides the shovel and crane, a ditcher, dragline and skimmer. All that is required are special booms and buckets.

A new crane was placed on the market in 1926 by the Moore Speedcrane Co., in which, as its name implies, special attention has been paid to speedy operation.

Special Features

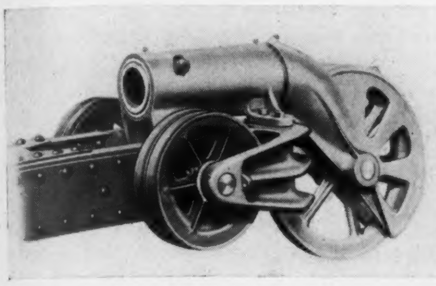
The Koehring Co. announce that "an important feature on its No. 1, ¾-yd. shovel is a power dipper trip, which was recently made optional equipment on Koehring shovels. The trip conforms to the Koehring principle of finger-tip control, inasmuch as the operator merely gives a slight touch to a conveniently located lever to trip the dipper



New power shovel convertible to crane, ditcher, skimmer or dragline

door. A twofold advantage is gained from this improvement. First, an extra man is eliminated from the cab, and, second, the operating speed is increased."

The power for the trip cable is obtained by building a small drum, with heavy brake lining on the outside, on the end of the rear drum shaft. A second steel drum, polished on the inside and placed over the first drum,

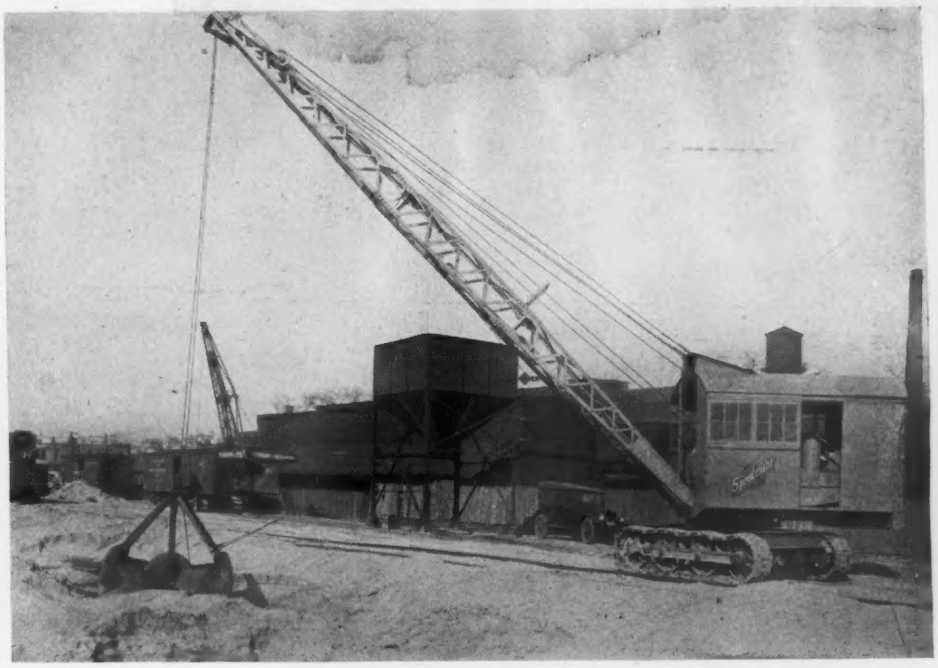


New type of boom point fairlead on dragline excavator

turns when there is sufficient friction between the two. The operator merely controls this friction with a lever so as to apply power to the trip cable which is attached to the outside drum.

The Koehring Co. also now offers a swivel type of boom point fairlead on its dragline excavators where sloped bank work is necessary. This is a new type of fairlead for the boom point and has been exceedingly successful.

By permitting the fairlead sheave to swing at will, the cable pulls directly over the center line of the sheave at all times, irrespective of the position of the bucket. All cross pull and friction between the sheave face and the cable is eliminated. In addition to giving longer life to the cables, it saves the swing clutches and increases the



A crane specially designed for speed

speed of operation. The operator finds it possible to drop his bucket on the right spot without giving his attention to the exact position of the boom.

The Koehring swivel type of boom point consists of a swivel sheave casting which journals in a cylindrical bearing. The bearing is rigidly supported by the boom point yoke, which in turn is bolted to the tip of the structural steel boom. This type of point is interchangeable with the regular boom point construction and can be easily put on in the field.

The Northwest Engineering Co. states that its designers "have improved the design of their shovel crowd to allow a greater degree of crowding power. The design is, to outward appearances, similar to that used on Northwest machines heretofore. But a two-part line arrangement which gives enormous crowding power has been added. The hoisting line *a* runs from the left-hand drum under the guide sheave over the boom point sheave and then down around the padlock sheave. It then continues back over another boom point sheave and thence down to a wide-faced sheave which turns freely on the shipper shaft. Two wraps are taken around this wide-faced sheave and from here the operator has the choice of running the cable to a dead end at the inner end of the dipper stick, or the use of the two-part crowd, which means that from the wide-faced sheave the cable continues around a sheave at the head of the dipper stick and thence down to a non-rotating guide sheave on the shipper shaft, where it is dead ended.

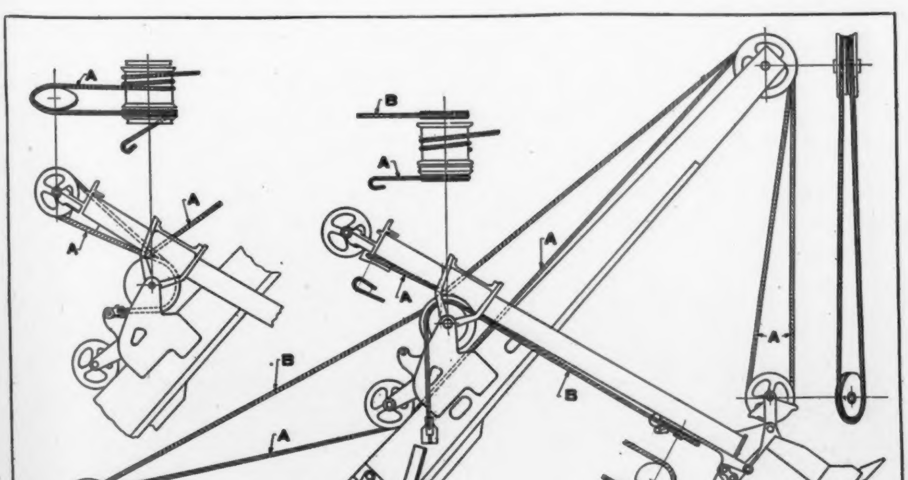
"The crowd-in cable *b* runs from the right-hand drum to a sheave on the shipper shaft down to a sheave at the dipper stick end casting and back to a stationary sheave on the shipper shaft, where it is dead ended.

"For most classes of work the hoisting cable is dead ended at the inner end of the dipper stick; but in quarry work or for hard, shallow grading or other classes of tough digging, the two-part line is a valuable advantage.

"The simplicity of the device is outstanding. There are no racks or pinions, boom engines, cable driven drums or spools, crowding chains or other crowding complications."

All-Steel Construction

The Harnischfeger Corporation has paid particular attention to ruggedness of design, stating that it "has spent over one million dollars in developing the present line of P&H unit cast-steel excavators. All this



New crowding device for the smaller shovels

New power shovel of unit cast steel construction

research and development work was done with the goal in view of offering to the trade a really permanent excavator, one to last and to work through many years.

"Many notable improvements have resulted, such as forged steel shafts in place of cold rolled steel, heat-treated pinions, double-cut gears, bearings bronze bushed, a perfected crowding motion, etc. Important as these are, they are but details compared with the recent announcement of unit cast-steel construction. For there is no great advantage in having a shaft or a gear outlive the machine itself.

"The new P&H machines are all steel from the tip of the boom to the corduroy shoes. The revolving machinery base, the car body and side frames and the corduroy frames, all heavy single piece steel castings constitute the framework or body."

Unusual Installations

The Orton Crane and Shovel Co. furnished the Great Lakes Portland Cement Co. (whose plant is now under construction at Buffalo, N. Y.) with what is believed to be one of the largest crane installations in the portland cement industry.

The equipment consists of two electrically operated gantry cranes, each equipped with 65-ft. booms and 4-cu. yd. clamshell buckets and one 30-ton crawling tread gasoline operated locomotive crane equipped with 70-ft. boom and 2½-yd. clamshell bucket.

The gantry cranes will be used for unloading boats and stocking material, each machine having a capacity of 350 tons per hour. The crawling tread crane is used for erecting the plant and later for reclaiming stone and loading cars. A unique feature of the installation is the use of the crawling tread crane in setting up the large gantry cranes.

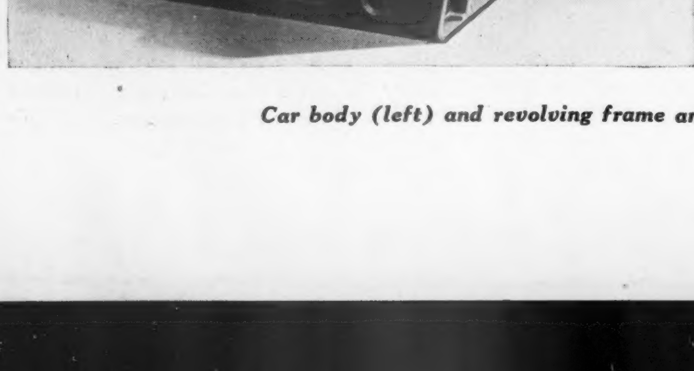
Each gantry crane is electrically operated by means of a single 150-hp. General Electric motor. All functions of the crane—that is, hoisting, traveling, swinging, and raising and lowering the boom are accomplished by means of double friction clutches. Each crane travels on four standard MCB trucks on two standard gage tracks spaced 20 ft. center to center. The wheel base is approximately 26 ft. and the clearance under the girders 22 ft.

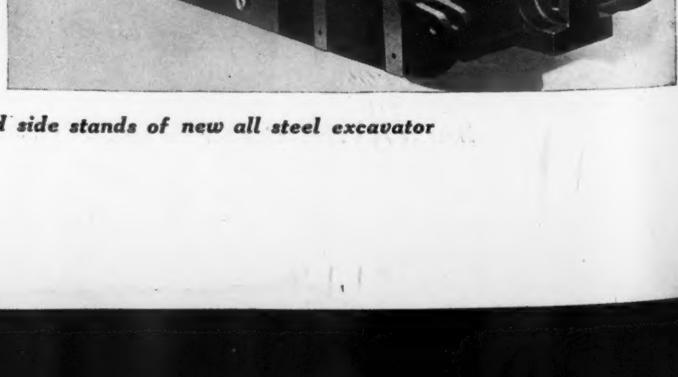
The crawling tread machine is equipped with 133-hp. 6-cylinder Climax heavy duty gasoline motor. The crawling tread width is 16 ft. and has an over-all length of 18 ft. The total weight of the crane is 135,000 lb. and is said to be the largest crawling tread type crane used exclusively for locomotive crane purposes.

Buckets

The Hayward Co. produced a rope reeved type of digging clam-shell bucket for use with crawler cranes, truck cranes, and similar equipment. This is made to fit these machines and operate within the weight and capacity restrictions of such equipment. The reeving of the bucket is variable so that it may be closed by means of 3, 5 or 7 sheaves, the fewer sheaves used the faster the operation of the bucket. The 7-sheave mechanism

New 4-yd. bucket for large crane





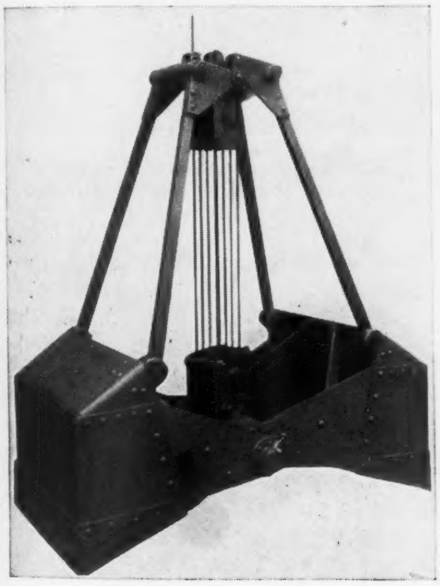
Car body (left) and revolving frame and side stands of new all steel excavator

applies where the digging is the hardest.

A similar bucket has been developed for light, fast rehandling work, made over the general design of this company's Class "E" bucket. This special type provides for the handling of materials on small truck cranes and derricks.

A third development of the Hayward Co. is the drag scraper bucket. This is made in various sizes and types for all classes of work from ½ cu. yd. up. The particular type constructed is a rugged, strongly reinforced bucket of great strength, which will withstand the severe usage to which a drag scraper bucket is subjected in its various applications to surface and sub-soil excavations.

The foregoing are typical developments rather than a complete resumé of the development and improvement of excavating equipment that has taken and is taking place. In no part of the equipment industry is competition keener than here.



New clam-shell bucket for heavy work

Hoists and Hoisting Equipment

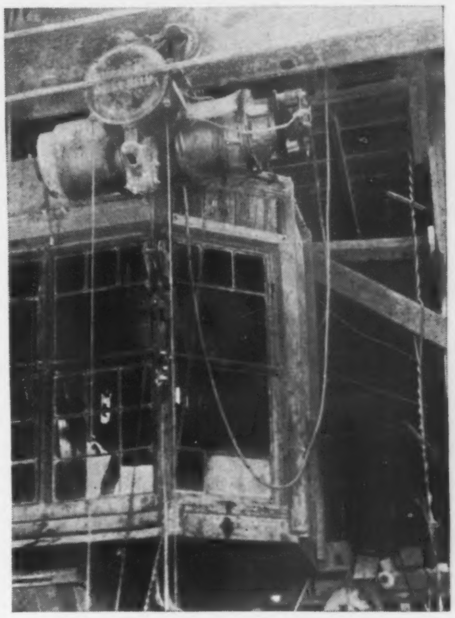
MANY improvements have been made in hoists and hoisting machinery during the past year and some very large hoists have been built. Perhaps the largest and most powerful hoist yet made was built by the Allis-Chalmers company for the Anaconda Copper Co. It has a 12-ft. drum with an

New clam-shell bucket for light work

8-ft. face and 15 ft. by 18 in. parallel motion post brakes and it is driven by a 2000-hp. direct-current motor which is supplied with current by a synchronous motor-generator set. It is of the semi-automatic control type and is the first hoist of anything like its size to which this control has been applied. The rope pull is 56,800 lb. and the rope speed is 2250 ft. per minute. Another large hoist built by Allis-Chalmers for the Michigan Alkali Works has a control of the liquid type arranged for push-button operation, and it is the first of its type to be supplied with this control and operation.

Electric Hoists for Crusher Service

Some of the photos below show an installation of an electric hoist made by the Shepard Electric Crane and Hoist Co. installed to lift and dislodge large rocks which become jammed in the crusher mouth. It is of special design for this duty and all vital parts are protected from dust and dirt by the metal housing which is a feature of this company's design. Several of these installations have been made at quarry plants and are interesting as further evidence of the 100% electrification of operations. These



Hoist over the mouth of a crusher

take the place of pneumatic hoists which have been standard for this purpose for many years.

S. Flory Manufacturing Co. made a large remote control hoist which was installed by the Edison Portland Cement Co. this year. This firm has also introduced quite recently a small gasoline hoist which is made in two sizes, with 10-hp. and 18-hp. motors. The first has a capacity for 1500 lb. at a speed of 160 ft. per minute and the second for 2500 lb. at 200 ft. per minute. Continental motors are used and Flory swinging gear attachment may be had if desired. These hoists may be supplied with two-speed reversing sheaves operated independently of drums.

The J. S. Mundy Hoisting Engine Co. introduced its three-speed hoist this year. This was described in the May 15 issue. The manufacturers say that they consider this to be one of the most important develop-

New scraper bucket for draglines, etc.

Crusher plant with electric hoist for handling large rocks at the crusher mouth

ments in hoisting machinery since the friction drum was patented back in the 70's.

Roller-Bearing Hoist Motor

The Milwaukee Electric Crane and Manufacturing Corp. show an enclosed motor with Timken roller bearings with which they are equipping their cranes. The features of this motor are the "sealed" construction and the positive oil lubrication. Both these prevent injury to the motor from dust and dirt as well as rendering it unnecessary to inspect, clean and oil except at comparatively long intervals. Other motors made by this company have had positive oil lubrication but this new model is the first that has combined it with Timken bearings.

The Wright Manufacturing Co. has introduced a new type of trolley hoist this year which is designed to use so little headroom that it can be employed where ordinary forms would not be thought of. The manufacturers say that while the regular 10-ton trolley hoist takes a minimum of 62½ in. between the bottom of the I-beam and the bearing point of the hoist hook, this new hoist takes only 13 in. for the 10-ton type. The regular Wright mechanism is employed.

The following hoists and hoisting machines were described in the New Machinery section of Rock Products in 1926:

Yale and Towne ball bearing electric chain hoists, Mar. 6.

Mundy automatic brake for Mundy hoists, Mar. 20.

Ingersoll-Rand D. V. portable gasoline engine hoist, April 17.

Caldwell new electric car puller, May 1.

Mundy three-speed hoist, May 15.

Morton trolley hoist, made by the American Engineering Co., June 12.

Friday drum type car puller, June 26.

Electric monorail hoist of the American Engineering Co., Sept. 18.

Novo light duty gasoline hoist, Oct. 2.

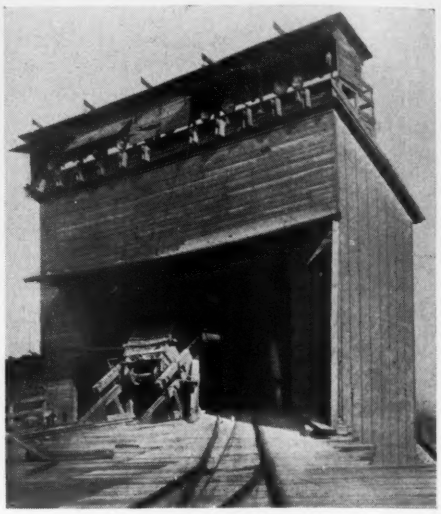
Northern Engineering Co. 1-ton trolley hoist, Oct. 16.

New Multi-Wall Paper Bags

THE JAITE CO. announces that a five-wall sewed paper bag has been added to the "Jaite family." The result of this new type of bag will be to increase the use of paper and that it will be universally adopted for shipments of heavier material, is the belief of the manufacturer.

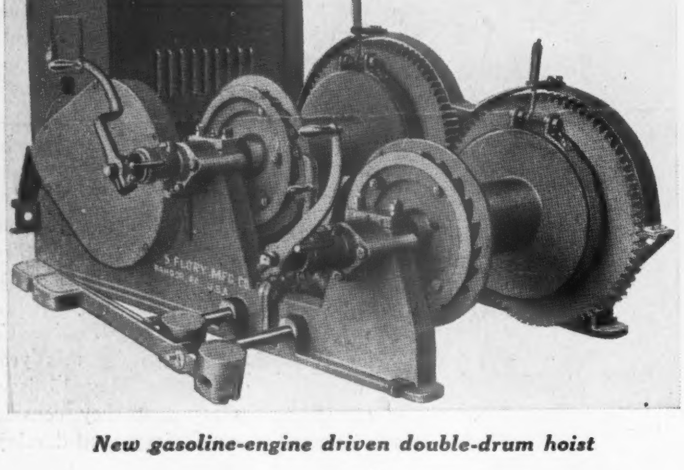
This company is a pioneer manufacturer of paper bags and operates one of the largest and most thoroughly scientific plants of its kind in the world—a large modern paper mill and bag factory entirely devoted to the production of cement, limestone and plaster sacks.

It has also been the policy of this company not to call on the dealers to ask them to specify this bag, as it is the opinion of the Jaite Co. that the better class of manufacturers of cement, lime, gypsum, etc., are interested in securing the best package obtainable.

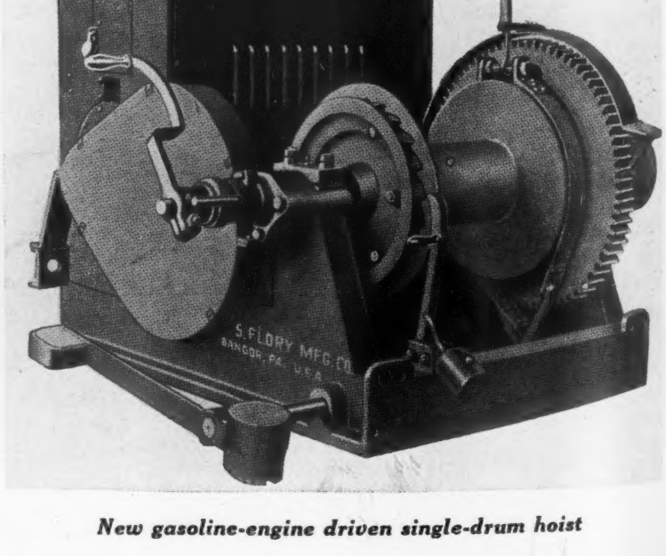


Electric hoist suspended at top of crusher building handles large rocks in crusher

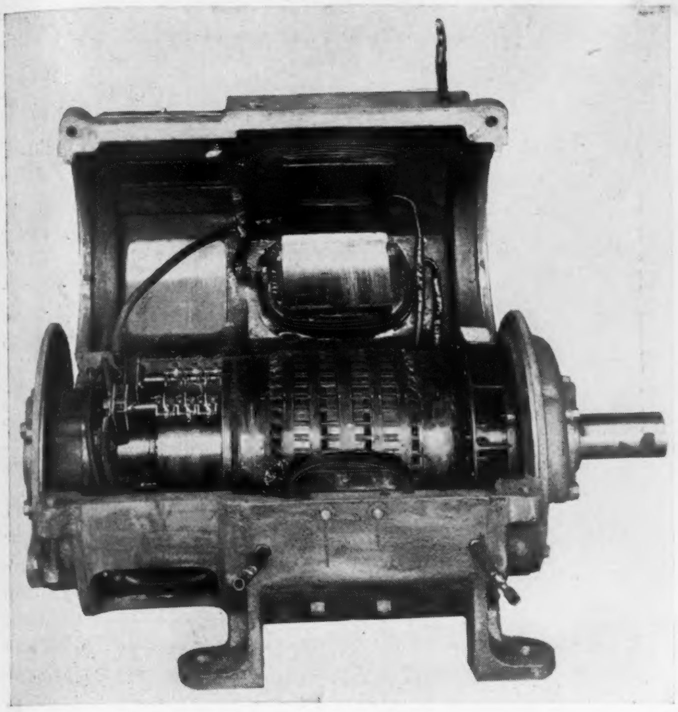
This is undoubtedly true. A quite thorough canvass of the building supply dealers recently by *Building Supply News* showed that they were practically unanimous for the multi-wall paper bag for portland cement shipments. However, there is still some objection to paper bags on the part of construction contractors who use large quantities of cement, on account of the slightly greater cost of paper sacks over returnable



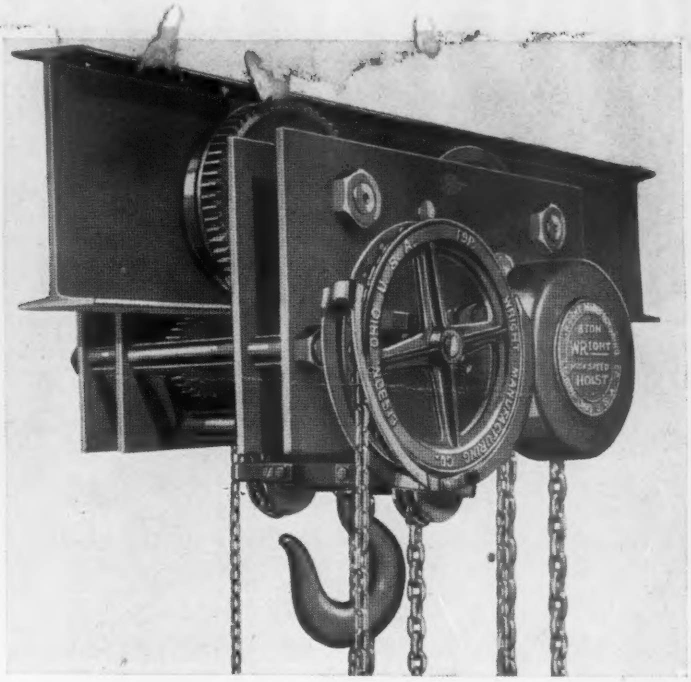
New gasoline-engine driven double-drum hoist



New gasoline-engine driven single-drum hoist



A crane motor with roller bearings



A recent development in small I-beam traveling cranes, or hoists for general utility work and repair replacements in crushing and screening plants, requiring 13-in. headroom

cloth sacks. Also the portland cement manufacturer has a very considerable investment in cloth sacks which he cannot afford to sacrifice.

However, the outlook is decidedly in favor of the multi-wall paper sack, and the situation looks so serious to Southern cotton interests that the Georgia state legislature was recently petitioned to require all cement used on state work to be shipped in cloth (cotton) sacks in order not to further depress the price of cotton.

Wire Rope and Tramways

ONLY one note concerning the use of wire ropes was published in the new machinery section of ROCK PRODUCTS in 1926. That had to do with the correct method of fastening cable clips according to the practice of the American Hoist and Derrick Co.

Wire ropes get unusually severe service on steam shovels. The American Cable Co. reports a very successful installation of its rope on a steam shovel in which the life of the rope was much longer than ordinary. This company warns against common causes of wire rope deterioration on shovels, such as using a pinching sheave and allowing the rope to weather, but adds the length of service in the case mentioned was due to the method of laying the strands.

The Broderick and Bascom Rope Co., which celebrates its fiftieth aninversary this year, notes in one of its publications the many uses found for wire rope at the new International cement plant at Norfolk, Va. These include digging the clay (with a dragline), unloading clay and marl (on a derrick and a locomotive crane) beside minor uses.

Interesting Tramway Installation

An important installation of a tramway in the rock products field was that at the plant of the Nephi Plaster and Manufacturing Co., Nephi, Utah. It was made by the Interstate Equipment Co. and connects the plaster mill of the company at Nephi with a newly-opened gypsum deposit. Surface hauling was out of the question on account of the rough country. The mine mouth is at 6,000 ft. and the line drops 570 ft. in its 9,500 ft. of length. The character of the country is shown in the accompanying pictures.

The tramway handles 40 tons per hr. and the fall is sufficient to operate it by gravity. A 35-hp. Buda gasoline engine is installed to move the cable if the buckets are not sufficiently loaded for gravity operation.

A 600-ton bin is built over the tramway loading terminal and the buckets are loaded from this by an automatic loader.

This form of tramway consists of a series of four-wheeled cars running on two track cables and propelled by an endless wire rope. The track cables are supported on towers and there are seven sections, each provided with counterweights to maintain a constant tension. Intermediate towers are placed between the tension towers.

At the discharge terminal the buckets pass through a "U" section. The cars are inverted and discharged on a baffle plate as they pass through this section and return to the line. Chutes below this baffle plate enable the bucket discharges to be sent to any one of three bins, each having a capacity of 200 tons. From the bins the gypsum is fed by gravity to the crusher. The system is economical and adapted to the country.

A recent cableway tramway installation for handling gypsum rock from mine to plant—Nephi Plaster and Manufacturing Co., Nephi, Utah

Bin at loading terminal—Nephi Plaster and Manufacturing Co., Nephi, Utah. A—Line of tramway to mill, and B—Old quarry face

Crushers and Crushing Machinery

THE year 1926 has been notable for the construction of three new 60-in. gyratory crushers—one by the Traylor Engineering and Manufacturing Co., illustrated in ROCK PRODUCTS, October 2, for a Michigan iron mine; and two illustrated herewith by the Allis-Chalmers Manufacturing Co. for a South American copper mine. The Allis-Chalmers crushers are described as follows:

"These crushers, weighing 1,000,000 lb. each, were designed and built for the Chile Exploration Co., a subsidiary of the Anaconda Copper Mining Co., for installation at Chuquicamata in the Andes mountains near Antafegasta, Chile.

"On account of the hardness of the copper ore which they must handle, the crushers are of an especially heavy design, built almost entirely of steel, the castings and forgings being among the largest ever made in this country.

"Two hopper openings, each 5 ft. across, permit a carload of ore weighing 70 tons to be dumped into the crusher at one time. Some pieces of the ore will weigh as much as seven tons. This will be reduced to a 12-in. product, each crusher handling from 2000 to 2500 tons of ore per hour."

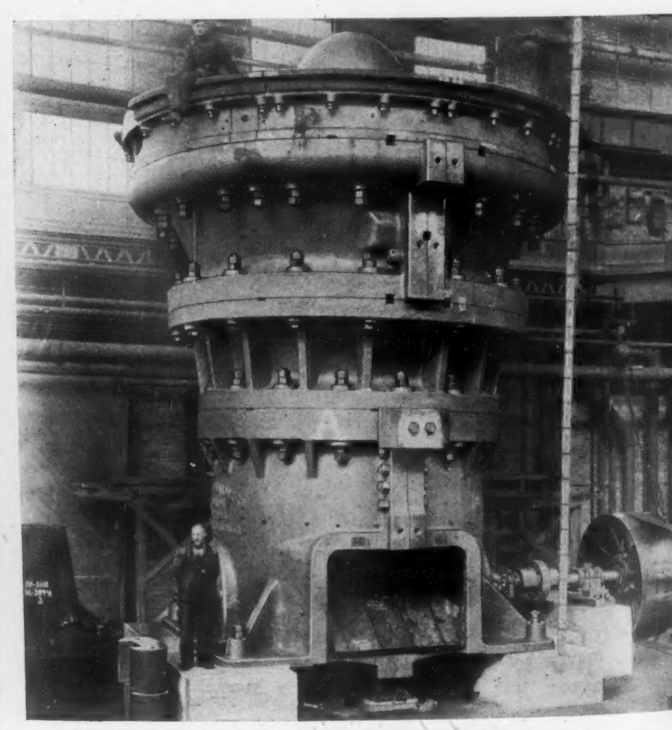
Other developments in crushing machinery by the Allis-Chalmers company include "the 18-in. Superior-McCully fine reduction crusher, which was mentioned in last year's review as being developed and under construction, has this year been put in operation and tried out in actual service. It has proved entirely successful and has fulfilled all the company's expectations as to reliability and capacity.

"Work has also progressed steadily on the perfection of the Newhouse crusher. Whatever experience could be gained by observing the performance of the 7-in. and 10-in. machines now in operation has been put to advantage in designing improved details for these sizes of machines, and has also been incorporated in the design of a 14-in. machine, which is now being tried out in the field.

"Finally, there has been developed a new type of crusher, which is designated as the Style 'C' crusher. This machine is especially proportioned for crushing very hard rock, such as trap rock. It combines some of the most valuable features of the standard Style K and McCully machines, but is in all parts very much stronger than either of these. Two sizes of these Style C crushers have been developed so far, i.e., No. 6 and No. 12."

Safety Device for Jaw Crushers

The Traylor Engineering and Manufacturing Co. announces a number of refinements in the design of the "Bulldog" jaw crusher, one of which is a safety device "which guarantees the user freedom from the danger of serious breakage of the machine in case overloading develops through packing or the accidental introduction of tramp steel in the feed, which has caused many breakages.



Top and side view of 60-in. crusher made for Chile Exploration Co. which will make from 2000 to 2500 tons per hour of a 12-in. product

"The device is of the simplest possible character, consisting merely of a small steel plate and a hardened steel punch, set into a recess in the rocker which forms the support of the front toggle plate.

"The placing of the punch and plate are such that when a dangerous strain is placed upon the crusher, sufficient to overcome the shearing strength of the plate, the punch is forced through the plate, the toggles drop a short distance and the machine is put out of action.

"The plate is chosen of a thickness having the yield point well within the line of safe operating strain, which is determined by the design.

"The punch is not injured when yielding takes place and the plate may be replaced in a few minutes, enabling resumption of crushing with very little delay."

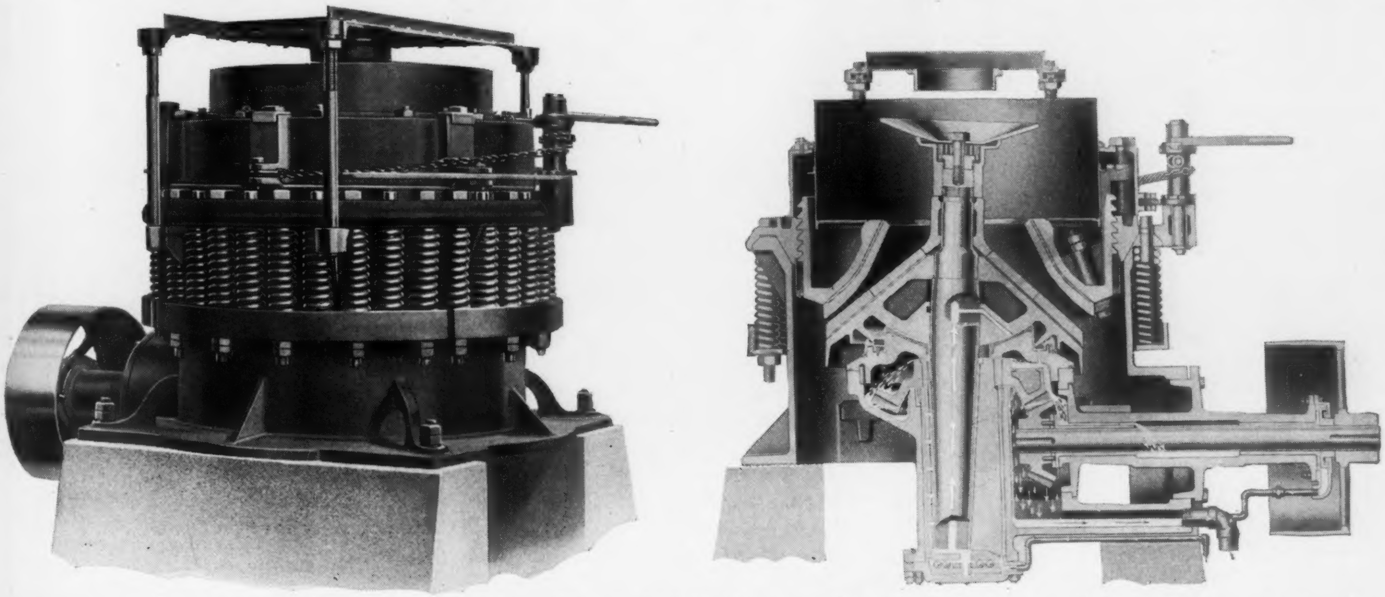
New Reduction Crusher

The Symons Brothers Co. announces in this issue of Rock Products a new reduction crusher with many special features. One of the first installations of this crusher, at the Winchester, Mass., plant of the General Crushed Stone Co., was referred to in Rock Products, September 18, in the article describing the use of motor trucks in this company's quarry.

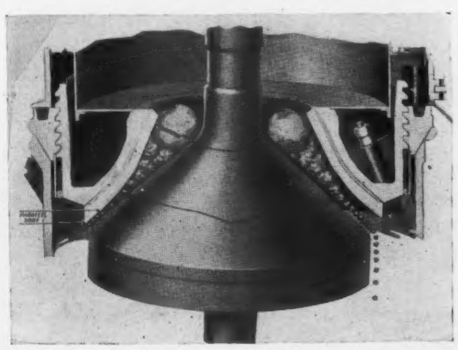
The new crusher is known as the Symons cone crusher and consists of a conical head gyrated by an eccentric that is driven through gears and a countershaft. The head is supported by a large socket bearing with no bearings or spider above the crushing cavity to obstruct the flow of material. Opposing the head is a crushing bowl threaded on its outer circumference for the purpose of raising and lowering it. The bowl is held in place by an adjustment ring, threaded inside to fit the bowl threads, and held down on the main frame by a circle of springs. A feed and regulating plate is mounted on top of the main shaft with a vertically adjustable feed spout above it.

"The gyration of the crushing head in the cone crusher is similar to that of the ordinary gyratory, with the exception that it moves at least five times as great a distance and gyrates faster. The action of the stone is entirely different.

"The rapid gyration and long movement drops the head from under the stone after each crushing impact and allows the stone to fall vertically away from the outer bowl. The number of gyrations of the head per minute regulates the distance the stone will travel between crushing impacts.



Elevation and section of a new type of crusher. The conical head moves five times as great a distance and gyrates much faster than the head of the ordinary gyratory



Head of crusher showing course of stone

"Since the stone falls a certain distance between crushing impacts, the angle between the head and the outer bowl regulates the amount of reduction at each stroke.

"The lower part of the head and the lower part of the outer bowl are parallel for a sufficient distance to insure the head making one complete gyration before the material will drop the entire width of the zone. This means that the closed side of the crusher regulates the maximum size of the product.

"The long movement of the head creates a large opening on the discharge side for the free exit of the finished material which gives the crusher an exceptional capacity.

"To change the size of product or to take up wear, six cap screws are loosened to allow clearance in the bowl threads. The bowl is screwed up or down with the aid of two rachet lever windlasses. When the desired setting is obtained, the bowl is locked in place by dropping a pin or bolt through a lock link. The six cap screws are then tightened to prevent play in the bowl threads. The adjustment does not change the position of the main shaft in its bearings. It is not necessary to stop crushing to take up wear or change the size of the product."

A pressure system of lubrication from a detached oil tank is also a feature of this crusher which adds to its serviceability.

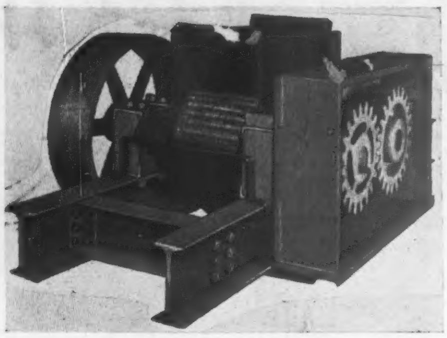
The crusher is made in various sizes, the smallest with a 2-ft. cone, the largest with a 7-ft. cone. The horse powers vary from 25 to 200, and the r.p.m. from 564 to 400. The smallest size, crushing to ⅛-in., has a rated capacity of 7 tons per hour, and the 7-ft. cone crusher set to ¼-in. opening has a rated capacity of 110 tons per hour.

Other New Crushers

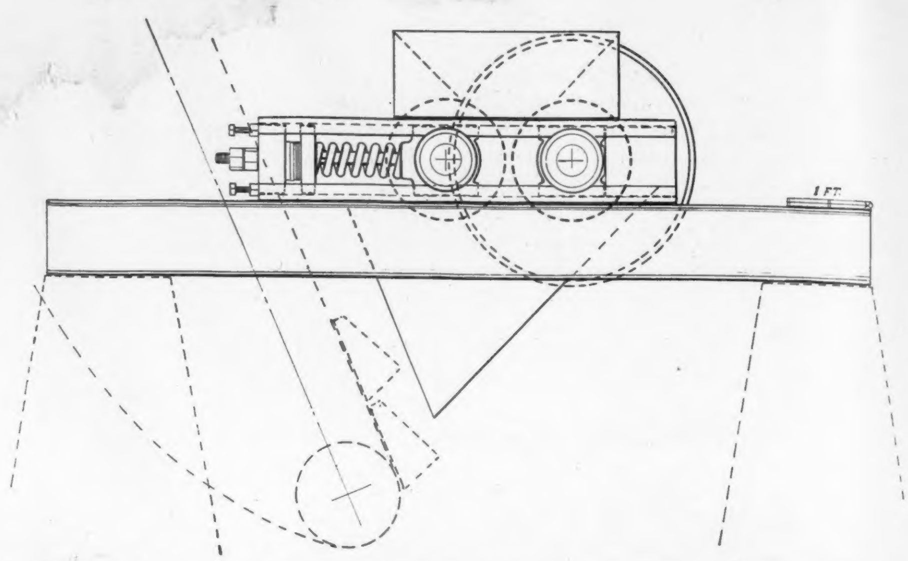
A new Western rock crusher, with a capacity of 30 to 45 tons per hour with a 2-in. opening, has been added to the products of the Western Wheeled Scraper Co. It has a jaw opening of 11x36 in. The weight on skids is 16,600 lb.; on wheels, 18,700 lb.; the floor space required is 92x91 in. The new model is No. 3.

The New Holland Machine Co. after more than a year of experimenting has designed a set of rolls which show some noteworthy improvements over the older type. These rolls, which are designed for use in the cinder block, stone and sand industries, are inexpensive in first cost and upkeep on account of their simplicity, are easy to operate and repair, have a large capacity and yet are said to be rugged enough to withstand the strain and jar of crushing hard rock.

The simplicity of design of these rolls is



New type of roll of simple and rugged design



Installation diagram of simple roll which was especially designed for making the finer aggregates

an outstanding feature. Exclusive of the sills and bolts, nuts and washers, there are but 28 parts in the two-roll outfit and twice as many in the four-roll outfit. One set of roll bearings are of the stationary type, the other set of the sliding movable type, held in place by heavy compression springs, which provide the means of passing tramp iron without injury to the outfit.

The rolls, made in coarse, fine and smooth surfaces, can be readily adjusted and the tension on the springs can be changed while the rolls are in operation. The only wearing parts are the shells, bearings, gears and shafts. Only two gears are used on each set of two, the double set of four having double drive. The sills are 10 in. and 12 in. I-beams with heavy webs.

Notwithstanding their simplicity and few parts, these 16x16 in. rolls are said to be of rugged design from their solid web pulley and heavy bearings to their 4-in. roll shafts, and have a proven capacity of 10 to 25 tons per hour. Reduction in size from 2½ in. stone to ¾ in. and smaller aggregates are made in a two-roll set. Each set requires but 10 hp. for operation, it is claimed.

These rolls, it is claimed, mark a forward step in the design of machinery for the production of the finer aggregates and should be of special interest to those desiring a greater output of these aggregates without resort to more expensive and complicated installations.

The Good Roads Machinery Co. is at present engaged in perfecting a line of fine rock crushing machines, or in other words is developing crushers for producing fine material. The first machine has been built, but has not yet been fully tested. Until this machine is thoroughly tested this company does not care to describe the machines in detail.

Sells Channeller Business

THE Sullivan Machinery Co., Chicago, Ill., announces that the channeller business of this company has been sold outright to the New Albany Machine Manufacturing Co., New Albany, Ind. All completed channeling machines, together with complete stock of parts, pattern drawings, tools, etc., have been turned over to the new owners. Orders for spare parts and for new machines should be addressed to them.

Pulverizers and Grinding Mills

DURING the year 1926 the Bradley Pulverizer Co. announced a new "Hercules" mill, 350 hp., with 10% more screen area and 50% more discharge port, and with a new feeding mechanism. (See ROCK PRODUCTS, April 3, 1926.) In our October 2 issue was described a new type pulverizer unit of the Combustion Engineering Co. for grinding coal.

The Fuller-Lehigh Co. announces a new pulverizer mill of the air-separation type, but manufactured in screen type if required. It is a recent development and utilizes the well-known grinding principles of the Fuller mill. Special attention has been given to distribution of weight to permit greater rigidity and to details of design to insure more accurate assembly and smooth running.

The mill is available in capacities from 3 tons to 20 tons per hour, which supplies the present demand for large capacity mills. It is made for either unit or bin systems.

The Lehigh pulverizer mill is described by its builders as "an especially stable and rigid unit. This effect is accomplished by building a massive base plate, which becomes the anvil for sustaining the jar and pressure of the grinding elements and support for the machined, taper-fitted grinding ring. It also forms a rigid support, from which is suspended the spiral bevel gear and pinion housing and bearings. They are lubricated by pressure oil feed.

"The top section contains the yoke, on which are mounted the pushers for actuating the balls, and the fan blades which lift the coal to the separating chamber, from which the finely pulverized coal is withdrawn by the exhauster and delivered to the cyclone separator.

"The base plate in this new type of mill rests directly on a concrete foundation. The foundation is hollow for receiving the underneath gear and pinion housing and the pinion shaft to which a motor is direct-connected through a flexible coupling, thus producing a very rigidly and center-supported pulverizing medium of marked efficiency and stability.

"Separate motor-driven bin-supported feeders supply coal to the mill."

For Wet and Damp Material

The Williams Patent Crusher and Pulverizer Co. states that its latest development is the "Non-Clog" Williams hammer mill. It is described by the manufacturer as follows:

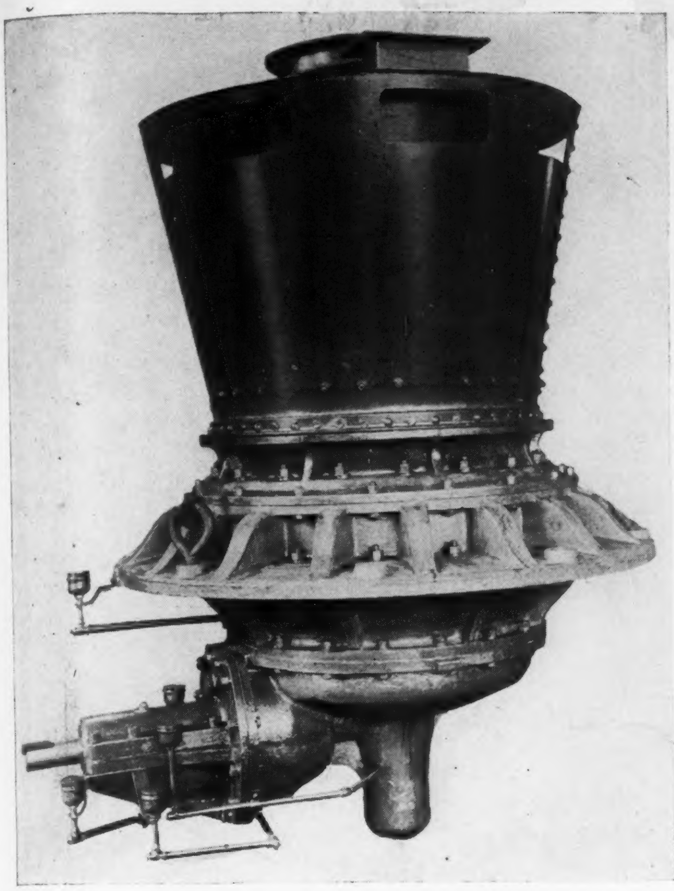
"Two types are offered, the revolving roll and the tractor type.

"For extremely wet material, the patented revolving roll is recommended as it has no links, openings or complicated mechanism into which rock and soft plastic material can wedge and pack. It consists of a single large diameter smooth-face roll against which the hammers reduce the material. It is rotated while the crusher is in operation and is cleared by a scraper on each revolution so that a clean surface is always presented to incoming material and it has no chance to accumulate. This roll can also be heated by steam or electricity, which further reduces the tendency of the wet material to stick.

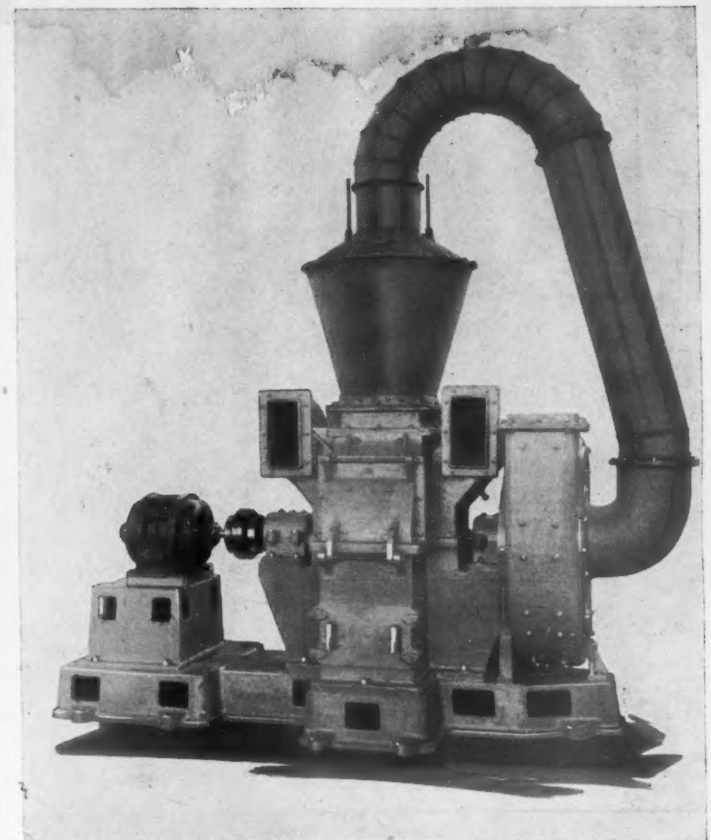
"Outer shell or casing covering the roll is made sectional, the sections of which are made of manganese steel and can be easily replaced when worn.

"The roll type breaker plate is the original equipment perfected for hammer crushers and has been used on material consisting almost entirely of wet clay so heavy with moisture that it was extremely plastic, yet the crusher did not clog.

"For handling semi-dry material or other work where the clay and rock does not lodge between the links, the tractor type is offered. It consists of a series of heavy links similar



A new type pulverizer of rigid design



Another recent type of mill especially built for fine grinding coal with air separation

to the treads of a caterpillar tractor, the whole making an endless chain which carries the material into the crusher and which serves as a breaker plate.

"These pulverizers are offered in either of the above types with self-contained drive, in each type the movable breaker plate mechanism being driven from the main crusher shaft by a silent chain drive tightly encased to keep out dirt and grit, so that no extra drive is needed."

The Dixie Machinery Manufacturing Co. states that its specially built hammer mill, designed to handle wet and sticky material (described in ROCK PRODUCTS, September 5, 1925) has been put to a new use for hammer mills, namely, for crushing quarry stripping at some cement plants, which use this material for a part of their raw mix. It is also stated that there are now three installations in the cement industry where this machine, known as the Dixie "non-clog" moving-breaker-plate, hammer mill, is used for both the primary and secondary breaker. This new type hammer mill, patented by Edward H. Frickey, president of the Dixie Machinery Manufacturing Co., has a revolving or moving breaker plate. This breaker plate revolves at a specified speed depending upon the nature of the material handled. The details of this crusher are illustrated in the accompanying view and cross-section.

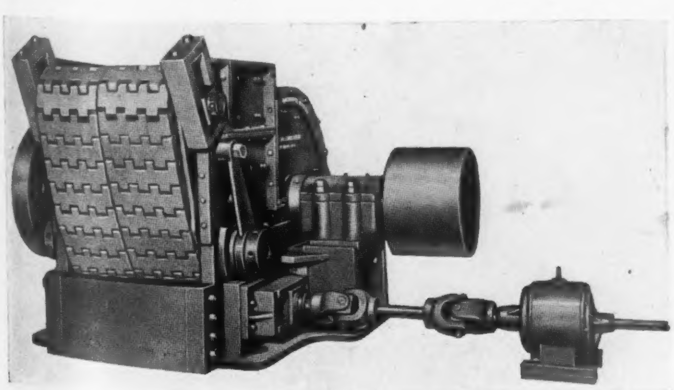
Ball and Roller Bearing Hammer Mills

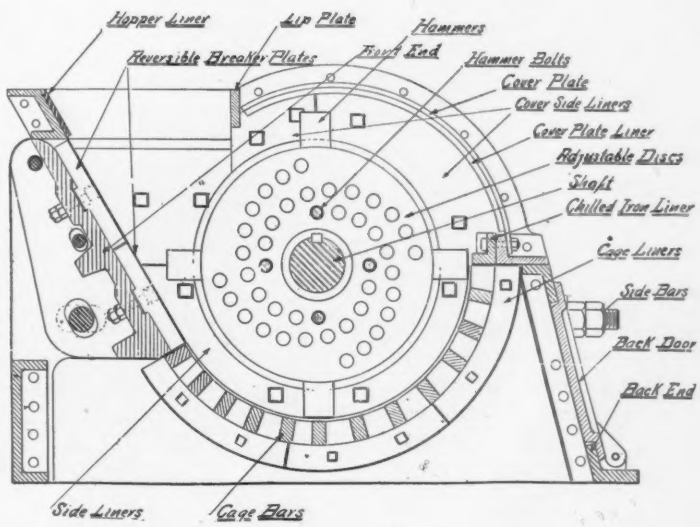
The Sturtevant Mill Co. announces an improvement and new application of hammer mills as follows:

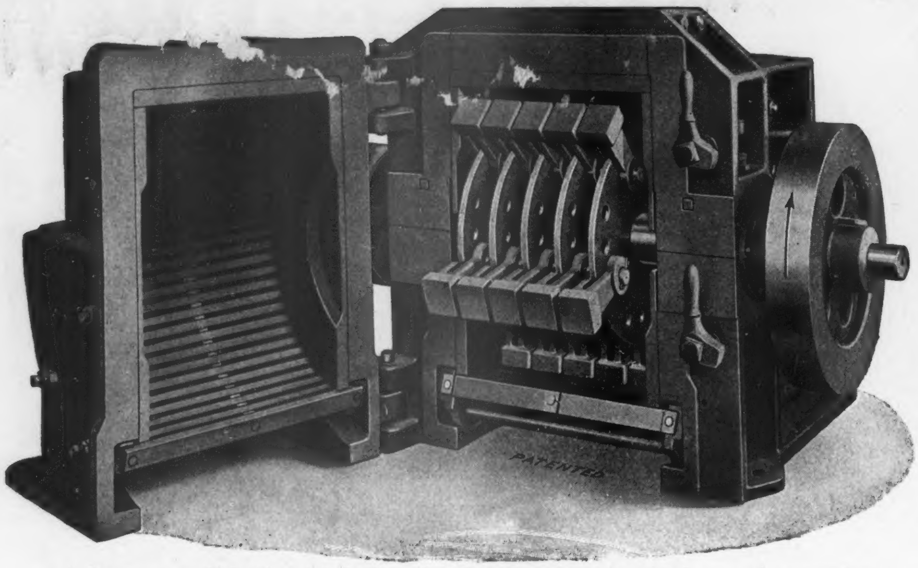
"To take advantage of the large percentage of fines produced by the hammer type of mill operating as a preparatory crusher for a pulverizer, the Sturtevant Mill Co. has redesigned its hammer mill bearings and now use the ball and roller types so that higher speeds may be reached safely and the fines in the product thereby still further increased.

"Thus a plant including a hammer mill, a pulverizer and an air separator operating in closed circuit, the hammer mill product going direct to the air separator where the

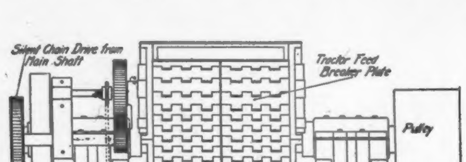
A mill which is especially built to handle wet and sticky material such as quarry strippings

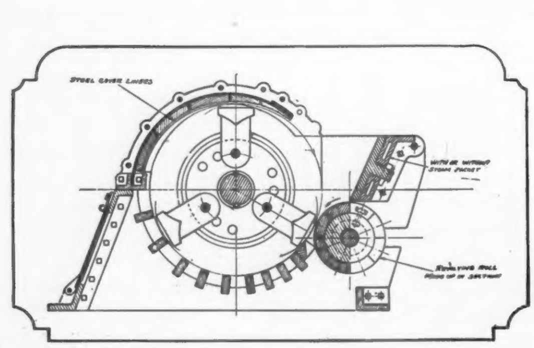






A hammer mill built with ball and roller bearings for high speed operation





Hammer mill built for handling wet and sticky material

finished material is extracted and the oversize passing to the pulverizer whose ground product again goes through the air separator, full advantage is taken of the unusual ability of these high-speed pulverizers to reduce a large part of their output to powder at one passage through.

"Thus if a hammer mill reduces 60% of its output to 100-mesh, this is immediately removed by the air separator and the grinding mill is only required to reduce the remaining 40% and its grinding members are not cushioned by a feed containing 60% of material already of the required fineness.

"This double closed circuit system is a new economy and by its use each machine is working to its highest efficiency.

"Also by this increase in speed, now possible by the use of ball and roller bearings, many of the softer materials may be finished by a hammer mill in closed circuit with an air separator, omitting the secondary pulverizer.

Unit Coal Pulverizer

A new coal pulverizer was placed on the market in 1926 by the Hardinge Co., known as the Hardinge unit pulverizer, which consists of the conical mill and the reverse current air classifier, and is capable of handling efficiently quantities of coal as small as 100 lb. an hour. The newest installation is at the Consolidated Mining and Smelting Co., Trail, B. C., Canada, where 3-ft. ball mills are grinding bituminous coal at the rate of about 300 lb. an hour. This operation replaced hand firing for the copper heating plant and has resulted so far in a net saving of nearly 20% in the quantity of coal used, and is also enabling this plant to use a cheaper grade of fuel. This system is also applicable to small boilers. The mill is a slow-speed machine of sturdy construction which can be operated for months at a time with nominal attention and no repairs.

Pneumatic Feed Control

A recent development by the Raymond Bros. Impact Pulverizer Co., which has found a wide application during 1926 in new installations in the rock products industry is a pneumatic feed control, which is described as follows:

"The Raymond pneumatic feed control consists of three main parts, the pawl lifting diaphragm, the controller and the suction nozzle. The power for the operation of this system is entirely derived from the suction of the fan and employs no electricity or other outside force. The entire action is pneumatic and the only movements which take place in the mechanism are the opening and closing of two small valves in the controller and the collapsing and inflation of the diaphragm on the pawl lifting mechanism.

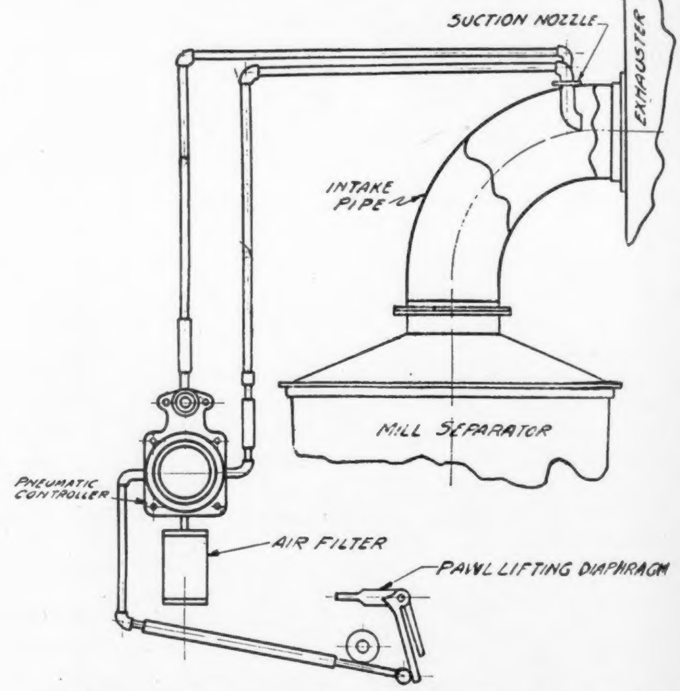


Diagram showing operation of pneumatic feed control

The valves operate on clean filtered air at a pressure of between 2 oz. and 5 oz. per sq. in. and their action is of the snap type so that the valve is either completely open or completely closed. Moreover, the capacity of the fan on a Raymond mill is so great when compared to the amount of air passing through this mechanism, that perfect seating of the valves is not at all necessary to perfect operation of the device.

"No oiling or adjustment is necessary inside the controller which is completely enclosed in a substantial cast aluminum case with brass screw cover.

"A thumbscrew for the adjustment of the desired load on the mill extends conveniently outside the case and is the only adjustment

necessary in the whole apparatus. Turn it clockwise for heavier load and counter-clockwise for lighter load.

"The suction nozzle is mounted on the upper side of the fan intake pipe about 18 in. from the fan flange and with its opening pointing toward the fan. Its function is merely to furnish a connection for the Raymond mill at a point where there is the maximum amount of suction. The smaller pipe extending down into the larger one is for the purpose of obtaining the pressure changes at this point.

"The controller is mounted near the mill in the most convenient location for the operator. Its function is merely to open the suction line from the fan to the pawl lifting mechanism when the pressure reaches a certain point and close it when the pressure falls. At the same time that the controller closes the suction line from the pawl to the fan it opens the line from the pawl lifter to the atmosphere so that free air can enter and thus allow the diaphragm on the pawl lifter to expand. At the bottom of the controller is a small bag filter for the air entering the system."

New Unit Fuel Pulverizer

The Raymond "Imp" mill, used for a unit fuel pulverizer, brought out between two and three years ago, was designed to use a regulator arrangement in the grinding chamber which was attached to the main shaft between the rotor carrying swing hammers for doing the grinding, and the fan wheel to carry the coal out of the mill. This mill proved quite satisfactory but was not the final answer to the subject. Since then there has been developed a later type of mill, shown in the accompanying illustration.

This latest mill involves a number of discs on a shaft running at a speed between 1,200 and 1,800 r.p.m. and between these discs are mounted swing hammers for doing the grinding. Above the grinding chamber of this mill is applied a special double cone air separator which has proved satisfactory in connection with all of the Raymond roller mills for extreme fine grinding, and also on pulverizers. On the main shaft of the mill is mounted a fan wheel with a fan shell. This draws the air and coal from the air separator and discharges direct to the furnace. The air separator classifies the coal, producing a uniform fineness. No matter how badly worn the operating or grinding parts are, the separator will always give the proper fineness. Capacity may drop off slightly because of seriously worn parts, but the fineness stays the same. This is one of the very important factors in the burning of powdered coal.

These mills are made in capacities from about 1,500 lb. per hr. to 15,000 lb. per hr., when grinding ordinary bituminous coal to a sufficient fineness for burning in various kinds of furnaces.

These mills are also applicable to small-capacity operations on such materials as limestone, lime, gypsum, and similar minerals. In that case the regular cyclone dust collector and piping system is supplied with them. When they are used as unit mills, they discharge direct to the furnace without any return air.

Cement Grinding Machinery

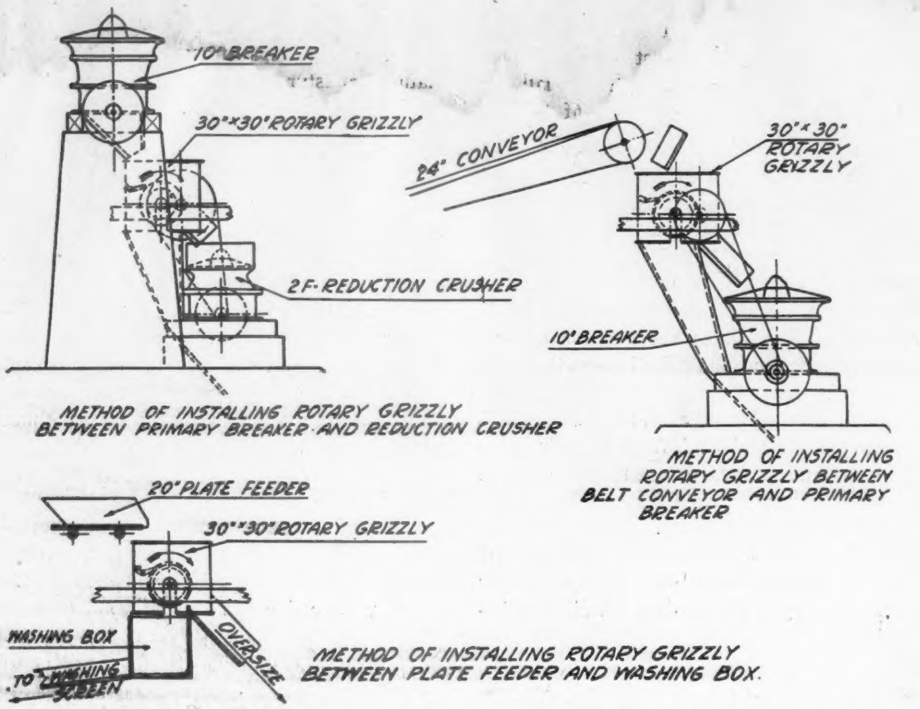
Some of the developments in mills, especially for portland cement manufacture, will be found under the head, "Cement-Mill Machinery," elsewhere in this issue.

Screening and Separating Devices

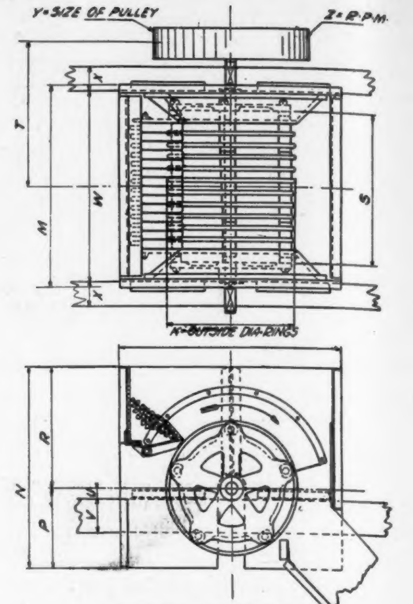
DEVICES for screening and separating material into sizes showed a marked improvement in 1926. Some of the new machines which have already been described in the New Machinery section of past issues are: The Frederick Iron and Steel Co.'s automatic hydraulic classifier (Sept. 4); longitudinal roll grizzly (Mar. 6); feeding arrangements of Link-Belt vibrating screen (May 1); Stephens-Adamson live roll grizzly (May 29); the vibrating screen of the Traylor Vibrator Co. of Denver (June 12); the Morrow Manufacturing Co.'s standard unit of scrubber and screen (June 12); the Robbins Conveying Belt Co.'s new unit vibrating screen (July 24); the Dorr Co.'s new

Large size manganese steel wire screen

Combination of stationary grizzly and vibrating screen—one of the interesting innovations in separation machinery—the grizzly saves the fabric ad makes an extra separation



Methods of installing rotary grizzly



GENERAL DIMENSIONS

SIZE GRIZZLY	K	L	M	N	P	R	S	T	U	V	W	X	Y	Z
30"×30"	30"	4'-6[illegible]	3'-9[illegible]	3'-9"	18"	2'-5"	2'-10"	2'-8"	2[illegible]	8"	3'-6[illegible]	6"	[illegible]	35
36"×36"	36"	5'-6[illegible]	4'-3[illegible]	4'-5"	21"	2'-6"	3'-4"	3'-1"	2[illegible]	8"	4'-1"	8"	[illegible]	28

Dimension diagram of rotary grizzly

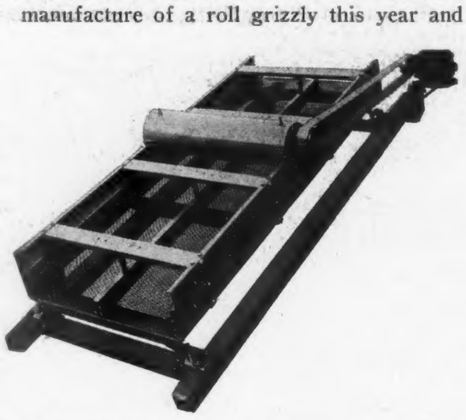
Roberts and Shafer's double-deck reciprocating screen (Sept. 18); Webster Manufacturing Co.'s self-cleaning bar grizzly (Oct. 2); Montgomery Coal Washing and Manufacturing Co.'s vibrating screen used for coal and slag (Oct. 16). A few of these will be mentioned in the review which follows because further improvements have been made or because they were not adequately described in the first place.

The material of which the screen itself is made has received a great deal of attention, as it is recognized that screen wear is costly, not only because of the expense for the material but because of the time that is lost in making screen repairs. One decided novelty in this line has appeared, the rubber-metal screen. The rubber is "welded" to the plate by the Vulcalock process of the B. F. Goodrich Rubber Co. and the combined plate is then perforated, the rubber being on the inside. As rubber will resist abrasion several times the period that metal of the same thickness will resist it, the rubber-lined screen has a very long life.

Manganese steel wire screens were introduced some time ago but important improvements in the method of making them allows them to be made of much heavier wire than formerly. The Manganese Steel Forge Co. recently furnished a "Rol-man" screen 70 in. long and 40 in. wide which had 3¾-in. square free openings and it was made of 1¼-in. diameter rolled manganese steel rods. Crossings rods are welded to outside rods on each of the four sides making the screen rigid and holding the rods in place. This is the largest size of manganese steel rod which has been woven into a screen.

Grizzlies

Roll grizzlies, of which the "Cataract" grizzly, made by the Robbins Conveying Belt Co., is a familiar form, have grown decidedly in popularity and are now made by several companies. The Stephens-Adamson live-roll grizzly has been already described in the May 29 issue. The Allis-Chalmers Manufacturing Co. has begun the manufacture of a roll grizzly this year and



Screen with clamp for fastening fabric

is making it in 15-in., 12-in., and 9-in. diameter rolls. Length can be made to suit any ordinary conditions that may be encountered.

The Telsmith rotary grizzly, made by the Smith Engineering Works, has been changed somewhat from the original form used in mining operations to adapt it to sand and gravel and crushed stone production. A diagram showing a typical installation accompanies this review.

Screens for Fine and Medium Sizing

The vibrating screen continues to grow in popularity for fine and medium sizing and it will probably continue to do so. Greater freedom from blinding and greater efficiency per square foot of area are advantages too great to be neglected. The aim of the designers of these screens now seems to be to reduce excessive wear by vibrating the screen so that there will be no whipping motion and so that the screen wires will not be flexed more than is absolutely necessary to permit the material to pass; which means that the frame as well as the screen is vibrated and that the direction of the motion is considered important.

The "Vibrex" screen, brought out in 1926 by the Robbins Conveying Belt Co., illustrates this as the screen frame holding the fabric is vibrated in a forward and upward motion, striking the material to be screened at a flat angle and urging it forward. The screen may be run with less inclination than many vibrating screens for this reason. Vibration is by a simple, unbalanced pulley and the screen cloth is held in tension by coil springs. The cloth can be changed in 15 minutes according to the makers.

The "Screen Supreme" of the Traylor Vibrator Co. (Denver) was fully described in the June 12 issue but recent installations have developed new uses for it. Former installations reported great efficiency on the coarse and medium sizes and a recent installation in a feldspar mill shows that it is equally efficient on the fine sizes. A capacity of 150 lb. per hour, per square foot, was obtained while making a 90-mesh product and the life of the fabric was very long in spite of the abrasive nature of feldspar.

The Universal Vibrating Screen Co. has made important improvements in its well-known screen. These include a clamping strip for fastening the fabric in the frame which holds the fabric well and lessens the time required for changing. The method of holding the cloth in tension has also been improved and the whole screen has been

made narrower, lower and more compact with an increased percentage of screening surface. The makers say that the cloth can now be changed in five minutes.

The Deister Concentrator Co. has made an interesting innovation in vibrating screens which it has applied to its Leahy screen, especially for screening sand, gravel and crushed stone. This consists of a bar grizzly placed above the cloth screen and vibrating with it. The grizzly scalps off heavy oversize and protects the screen below as well as making an intermediate product.

Hydraulic Classifiers and Sand Settlers

Hydraulic classifiers of the sort which use a rising current of water should be more used than they are in washing sand and other finely divided minerals. One reason why they have not been more used is that no machine of the hindered settling type has been on the market, with the exception of some old forms which have pretty much gone out of use. The Dorr Co. has remedied this state of affairs by bringing out the Fahrenwald sizer which is a true hindered settling classifier with an automatic discharge. It was described in the September 4 issue.

Such a machine is especially useful in washing and grading sand and for the removal of lignite, clay balls, chips, leaves and similar foreign material from sand. As it makes a series of products the grading of the sand may be controlled as desired. If a finer sand is wanted some of the coarse discharge may be cut out and if a coarser sand is wanted some of the finer discharge may be cut out. If the sand has not enough of the intermediate sizes to meet specifications it may be made to meet them by cutting from both the coarse and the fine ends, or, per contra, a part of the intermediate sizes may be cut out to increase the percentage of both coarse and fine. The machine has a larger capacity than most devices of its kind which especially adapts it to the sand and gravel industry in which tonnage is so important.

The same company brought out a sand classifier in 1926 which promises to find a large use in washing sand and the finer sizes of crushed stone, phosphate rock, and like mineral products. It is a variation of the dewatering wheel arranged to take very little headroom, and designed especially to handle heavy tonnages. The cut shows it installed on the dredge "Magic City" described in the December 11 issue. Where it is handling "sand" from crushed coral rock, and the illustration shows the way in which the machine operates very clearly. This machine was thoroughly tried out at commercial plants before it was placed on the market.

Magnetic Separation

Magnetic separating devices for removing tramp iron have come into greater use than ever during the past year, according to reports received from both the Magnetic Manufacturing Co. and the Dings Magnetic Separator Co. It is coming to be universally recognized that the few cents spent for current is one of the cheapest forms of plant insurance. Sometimes even this small cost is reduced by the salvage value of the iron and steel recovered. Hammer heads, parts of cars and the like are worth saving and the magnet picks them up at a place where they are handy to the repair shop.

Especially, stress is being laid on the value of magnetic separators in coal grinding plants where tramp iron or steel may easily cause a spark that will start a fire.

Vibrating Screens for Sand and Gravel Plants

By HARRY STRUBE
Engineer, Link-Belt Co.

THERE are two methods of sizing sand and gravel over screens, i. e., by the wet process, where sufficient water is added, either as a mixture or in the form of sprays; and the dry process, where material is handled just as it comes from the pit. With the increasing exactness of specifications for concrete aggregates, not only is it necessary that loam, clay and other foreign substances be removed, but a clean separation of the sand from the gravel must be made. It is obvious that this can be done only with the assistance of water, so that about the only places where dry screening is permissible are in isolated cases, where specifications have no bearing, and in the preparation of material for gravel roads. Occasionally one sees an exceptionally clean bank of sand which can be used just as it appears, but this is a rare occurrence.

The two accepted types of screens for grading sand and gravel are the revolving cone or cylindrical and the vibrating types.

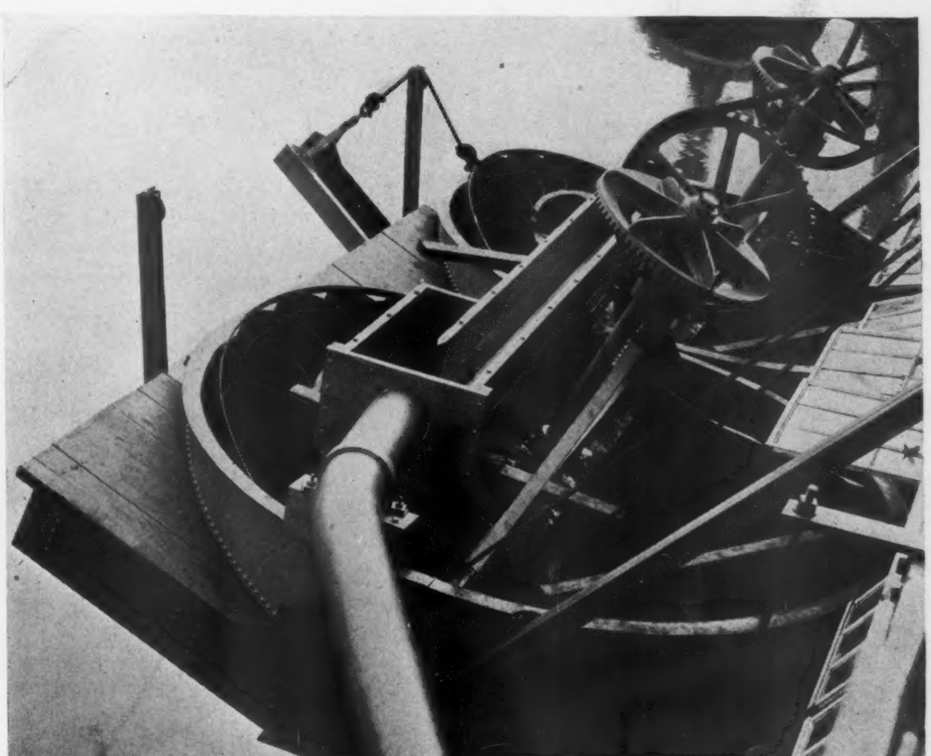
In the dry separations, the presence of natural moisture makes it impossible to use a screen mesh of less than ⅛-in. on a vibrating screen, and about ½-in. on the revolving type. For this class of work the vibrating screen has the advantage. The coiled wire cloth is well adapted here, although the smallest space that can be made between wires is ⅛ in. In dry screening, neither the revolving nor the vibrating screen will make clean cut separation of sand from gravel.

In wet separation, both the revolving and the vibrating types have their limitations. The former begin to blind when the openings get down as small as ⅜-in. to 5/16-in., while the latter work best when fitted with cloths having about 1-in. clear openings and under. Where the material contains dirt and clay the revolving screen is by all means the best adapted, because of its scouring action, which, with the assistance of water, removes the coating from gravel particles. The vibrating screen merely acts as a grader, and, aside from the force of water sprays, will not remove foreign materials as readily as the revolving screen.

For most plants therefore, a rule may be formulated to the effect that the revolving screen should be used for openings down to 5/16-in. or ¼-in., while for finer separations the vibrating type is best adapted.

Reasons for Installing Revolving Screens for Washing and Grading Sand and Gravel

1. Scrubbing action of screen jacket against material, and of material against itself, removes with the aid of water sprays, such foreign matter from the surface of the pebbles as clay and loam.



The new sand classifier installed on the dredge "Magic City"

2. Materials remain in a revolving screen longer than on a vibrating screen, due to the fact that the pitch of former is about 1¼ in. in 12 in., while that of the latter is 8 in. in 12 in.

3. Revolving screens are capable of withstanding overloads (without losing efficiency) better than vibrating screens.

4. Revolving screens are good distributors over bins or storage piles, whereas vibrating screens require longer chutes.

5. Revolving screens take considerably less height over the top of a bin than vibrating screens making the same separations.

6. Down to ⅜-in. round openings, revolving screens will make a perfect separation of the sand from the gravel, unless there is an overabundance of the former.

7. A revolving screen installation is usually cheaper, compared to one using vibrating screens for the same separation.

Reasons for Installing Vibrating Screens for Washing Sand and Gravel

1. For openings less than 5/16-in, the vibrating screen is the only type capable of maintaining open meshes.

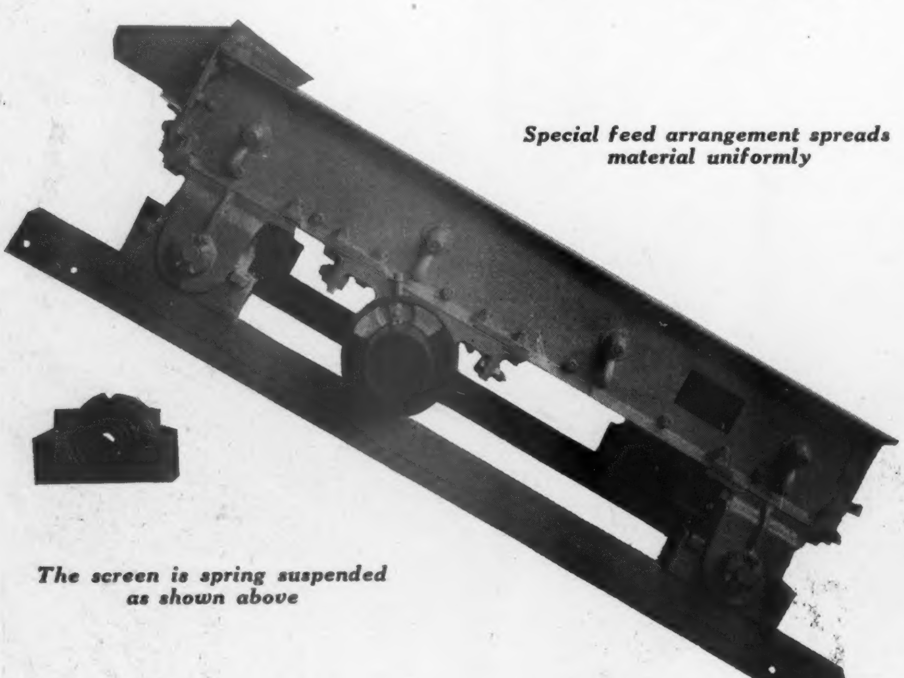
2. The screen cloth can be replaced in comparatively few minutes where there is a demand for quick change in specifications for gravel or sand.

3. The installation is very compact where quarters are crowded.

4. The application of power is simple.

5. Where material is free from objectionable foreign matter, the vibrating screen will grade from 1-in. openings down to 30 mesh, better than the revolving screen, on account of the accessibility of material on the screen to the force of water sprays, and its ability to keep meshes open.

6. Tonnage capacities are greater in a vibrating screen per square foot of screening area.



Special feed arrangement spreads material uniformly

The screen is spring suspended as shown above

Vibrating screen for sand and gravel plants

Alloys and Special Steels

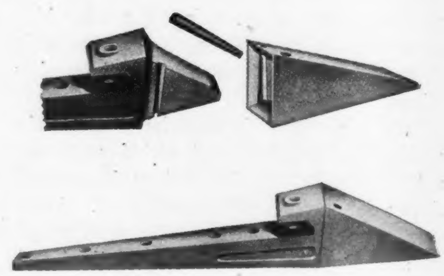
A CONSTANTLY wider application is being found in the rock products industries for such special alloys and metals as "Stellite," "Adamite," "Strenes" metal, and others known by trade names.

For example, during the past year Strenes metal lifters, or shelves, were installed in the kilns of the new Wabash Portland Cement Co. plant at Osborne, Ohio. These lifters are in the form of shelves which extend 12 in. in from the brick lining of the kiln and each shelf is 4 ft. long. They are installed, four to a complete circle around the kiln, and are staggered in such a manner that the 32 castings take care of approximately the first 35 ft. in from the upper end of the kiln.

The advantages gained are: The slurry is thoroughly dried out in this first 35 ft. of travel. Temperature maintained in kiln is uniform at all times. It is impossible for mud rings to form at any point, as the lifters are continually keeping the slurry agitated until it is thoroughly dried out. Each shelf picks up its particular load of slurry and carries it to the top of the revolution of the kiln, then drops it so that all slurry is carried through the super-heated space at the top of the kiln and all heat is thereby utilized. Clinker delivered to cooler is absolutely uniform in size and in all other characteristics.

The Advance Foundry Co., manufacturer of Strenes metal, has also furnished clinker chutes and liners to the Wabash Portland Cement Co., Southwestern Portland Cement Co., Lehigh Portland Cement Co., and from these installations there has developed a clinker chute and liner of a special type.

The liner is lapped over the chute in such a manner that the chute proper is protected from the abrasion of any hot clinker. Across each edge of the chute liner is a ledge ½ in. high and usually 1½ in. wide which tends to retard the flow of the clinker sufficiently to cause it to make its own bed, thereby removing considerable abrasion from the liner proper. These ledges are placed at each end of the liner casting so that when the ledge has been worn away from one end the liner can be reversed and its life in service doubled. When replacements are necessary it is only a question of shutting down the cooler until such time as temperature has dropped to a point where workmen can travel up through the cooler; they can then carry out the old liner and drop a new one in place and the cooler is again ready for service, avoiding any necessity for bolts or fastenings of any nature which would slow down this replacement operation.



Replaceable and reversible dipper teeth of alloy steel

New Shovel Dipper Teeth

Another field for special alloys, which in the past has been largely filled by manganese steel, is for such things as steam-shovel dipper teeth. The Western Crucible Steel Co. has recently placed on the market a replaceable dipper tooth which is described as follows: "This 'Westeeco' tooth is made of special alloyed steel, which is harder and tougher than the ordinary steel and, due to the patented features of this tooth, operators can save a great deal of time, in as much as it takes but a very few minutes to change or reverse these teeth. Actual tests have proven that one man with a hammer and drift pin can reverse four Westeeco teeth on any bucket up to 2½-yd. capacity, in less than 5 minutes' time. These teeth are now being used quite extensively in the iron mining district of Minnesota and Michigan. We have several sets in operation in various quarries throughout the country. They are in use digging chert rock in Alabama, coral in Florida, hard clay in several of the southwestern states, where they use them quite extensively on skimmer buckets for breaking up old concrete or macadam roads."

Cars, Locomotives, Motor Trucks

AN outstanding development in quarry tranportation in 1926 was the adoption of motor trucks at two of the best known eastern quarries, as described in ROCK PRODUCTS, September 18. During the year in our New Machinery pages we have noticed and described four developments in motor trucks for heavy service in this field—the White new heavy duty truck; the General Motors Co., new "Big Brute" truck; improvements in the way of stronger body joints in the Pierce-Arrow and the new 5-ton Hug truck.

In the field of cars and locomotives we find in our issues during the past year, in chronological order, the announcement of a new line of gear-driven gasoline locomotives by the Davenport Locomotive Co., ranging from 8 to 20 tons; a new Vulcan Iron Works 8-ton gasoline locomotive with three-point suspension, similar to standard practice in steam locomotives, and a description of new types of all-steel quarry cars by the Easton Car and Construction Co.

Locomotives

Most of the new things in locomotives have come in gasoline locomotives and are chiefly a tendency to increase size and weights—for example one builder is producing a standard 24-ton locomotive—and to make more and more refinements in drive and spring mechanisms. The gasoline locomotive was originally introduced as the most miniature kind of an industrial locomotive—it is now taking rank with steam locomotives for such heavy work as switching standard gage railway cars, even by the railway companies. The Plymouth 24-ton gasoline locomotive illustrated herewith is designed for such service, as well as for modern quarry work (The Lawrence Portland Cement Co. has one in quarry service.) This locomotive has four speeds forward and reverse, and can travel from 15 to 25 miles per hour in high gear.

The Milwaukee Locomotive Manufacturing Co., advises that its latest development is a 20-ton, 4-speed gasoline locomotive. It is built in gages from 30 in. to 56½ in. The speeds are 2 to 18 miles per hour, with draw-bar pulls ranging from 10,000 lb. to 2770 lb., at the limiting speeds noted. The engine is a Beaver Model RY, 6-cylinder, with 6½-in. bore and 7-in. stroke. The locomotive is chain driven with four heavy special alloy steel roller chains of 2½-in. pitch. All bearings except those of the engine and transmission (which are automatically lubricated) are provided with "Alemite" grease fittings, journal bearings are lubricated with oil.

The Mid-West Locomotive Works also announce a new powerful gasoline locomotive for switching, but in smaller sizes than the foregoing. They are 8-and 10-ton. Both are built on the same general design. Foot boards, hand bolts and full-size automatic couplers are provided at both front and rear, conforming to I. C. C. safety regulations. Some of the special features of these locomotives are described as follows:

"The drive wheels are located inside the frame to eliminate the danger of men getting caught by the wheels or brake rigging if located outside the frame. Four speeds are provided both forward and reverse. The driving stress is not applied through the axles but direct to the drive wheels by the axle sprockets being attached to the back side of the wheels, which eliminates the loosening of the sprockets and wheels on the axles. The only function of the axles is to carry the weight of the locomotive. Accurate and close adjustment of the drive chains is provided for by large adjusting screws in the jaws for the axle bearings. Semi-elliptic leaf springs, instead of coil springs, are used which afford excellent riding qualities, as the locomotive is supported at eight points instead of four. The frames are castings, embodying a large proportion of open hearth and manganese steel. No sub-frame or structural mounting is used to carry the engine and transmission, as these are mounted directly on large ledges cast as a part of the frame."

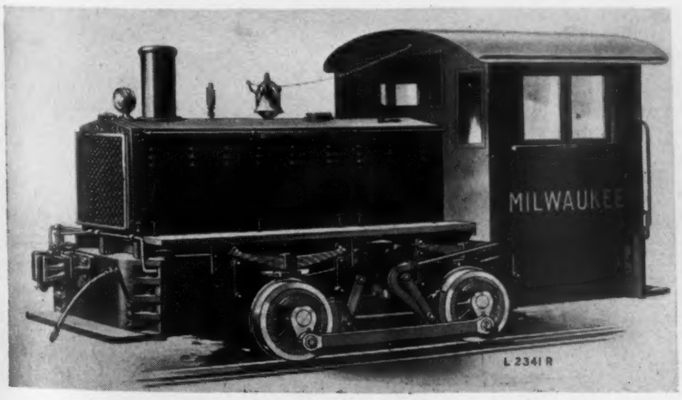
One of the new 8- and 10-ton gasoline locomotives

The Brookville Locomotive Co. has produced during 1926 several new models of gasoline locomotives which are described as follows: "The 4-ton Model FCR and 5-ton Model FDR are similar in many respects to Brookville Fordson locomotives as manufactured since 1922. With the exception of reverse mechanism which gives locomotives three working speeds in both forward and reverse work. Both locomotives also have added weight over the older models, for with the advantage of three forward and three reverse speeds the Fordson engine has ample power to handle extra weight and traction to advantage. Model FA is a 3½-ton machine, placed on the market during March, 1926. Also 6-, 7- and 8-ton models were developed and placed on the market during 1926. All three machines are powered with the Fordson tractor. Necessarily they carry a slow speed range so as to permit the Fordson tractor power unit to handle weight and draw bar pull to advantage.

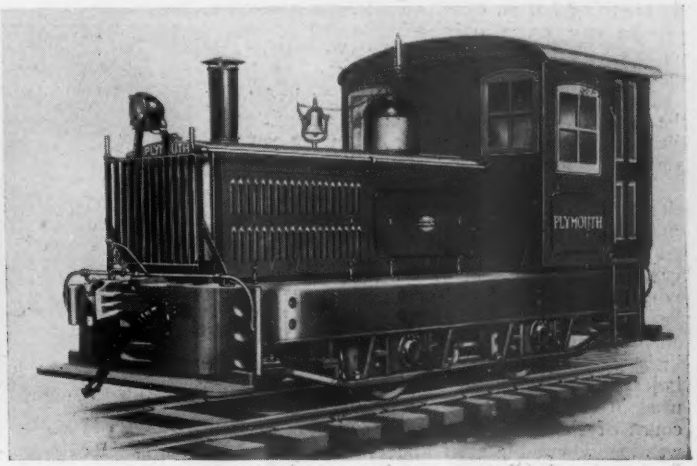
"For faster and more powerful locomotives—models 1-BY, 6-ton, and 1-BX, 9-ton—the Brookville company is applying the McCormick-Deering 10-20 as power unit in identically the same manner as employed with the Fordson."

Steel Cars

There has been a notable advance in the design, construction and use of all-steel cars with many refinements. A prominent manufacturer of all types of quarry cars, W. E. Farrell, president of the Easton Car and Construction Co., contributes the following:

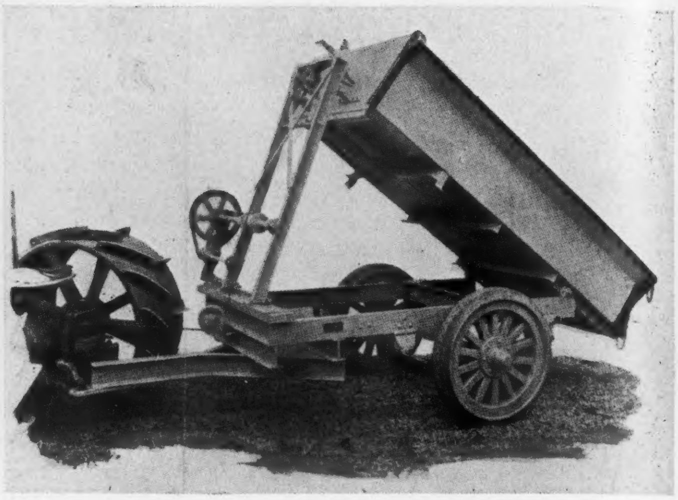


A new 20-ton gasoline locomotive which looks like a steam one



The largest gasoline locomotive yet—24 tons weight

One of the new locomotives using a standard tractor unit for power



A new tractor-trailer which may have many uses at rock products plants

A trade journal, speaking of steel cars in 1893, said editorially:

"The steel car has proven either too heavy, too complicated or too expensive for repairs, although it is practical and superior to the wooden construction."

For many years car construction has held tenaciously to the details of its precedessor, the wagon.

Fabricated from timbers held together by nails, spikes, straps of iron, lag screws and bolts, their inefficiency and inadequacy became more and more apparent as the loads became larger and the service harder.

The encroachment of steel was slow but nevertheless relentless. Beginning with the bolster gradually a part here and a part there yielded to the superiority of composition wood and steel construction until finally the bolster surrendered to all-steel construction.

Any advance in the art of building steel cars was so long delayed that the wooden car became a by-word of inefficiency. This delay was due to prejudice, the most unreasonable and unreasoning; to a failure or two due to the incompetence and inexperience of the designers of cars with steel frames, and to that fallacious weakness of salesmanship that *low first cost* and not *service* means sales.

The early failures of the wooden cars were forgotten and prejudice overlooked the existing failures of the wooden cars.

Truly it has been said that "Car building is anything but an exact science, the correct design can come only after experiments, errors and perhaps failures, but by this experience success is ultimately achieved."

Nevertheless the vision of the few had to be reckoned with, and in 1895 a committee was appointed to report the following year on *"metal underframes* for cars."

The committee reported that metal underframes had their advantage if they were made of standard rolled shapes and not special forged or pressed sections; or steel castings not used because of long delays when any repairs are required. There should be no holes punched in the flanges of the channels or I-beams. There was a decided insistence upon turned bolts and reamed holes unless an ample supply or rivets was used in the connections. And lastly on account of the great danger of sweating and wasting where the steel underframes joined the wooden flooring, that, unless a satisfactory paint could be found, the steel at these points should be galvanized or lacquered.

The committee further reported that, while the steel frame car and the wooden cars had in common 50½% of the total cost of repairs, a careful calculation of the repairs to the steel-frame car would show a saving in repairs on the other 49½%, and that through more continuous service on the road due to fewer days in the repair shop of the steel-frame car over the wooden car, the steel-frame cars would earn 36% per annum on the extra capital invested due to the greater cost of the steel-frame car. This saving was amply sufficient to warrant further consideration of the steel-frame car.

It was pointed out that the lowering in the price of steel with betterment in quality must soon offset the increasing cost of lumber and depreciation in its quality. As to the question of the necessity of often repainting the steel frame, it was stated that a sample steel-frame car had been built four years before (in 1892) upon which not a cent for repairs or paint had been spent to date.

To quote one speaker, "Don't think about the cost. Build a good steel car, and you will not see all the nuts hanging loose and doing no good when you look under the car."

This report and the discussion which followed led to the appointment that year, 1896, of a committee of five, each member of which was asked to submit an individual design the following year, 1897.

Then designs were submitted and discussed, but no definite action was taken, as the manufacturers of steel cars were entering the field and had steel cars *on exhibition* —not only cars with steel frames, but *all-steel* cars.

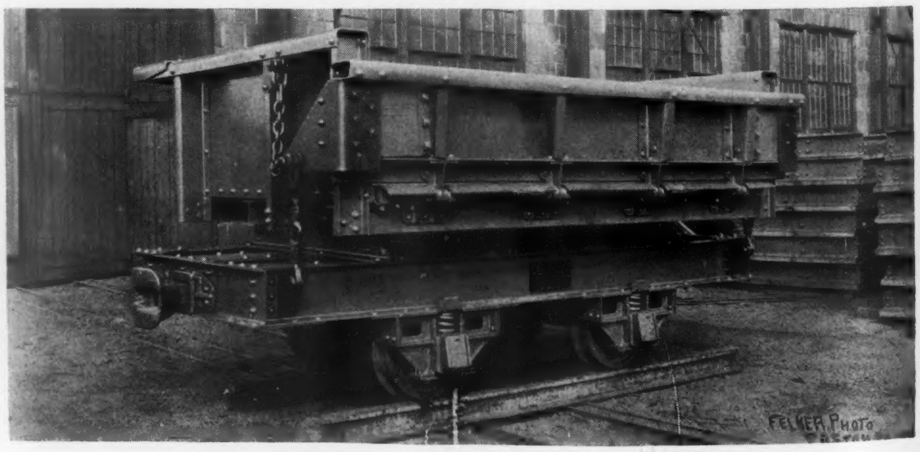
A steel-frame car was exhibited which had actually been in use 4½ years "at no expense for repairs—not even a single nut had been tightened. Compare this with a wooden car which has to have every nut gone over a few months after it has been put into service. This steel underframe car will be in service five years from now."

"Think of the advantages," says this same speaker. "Think of the advantages of using metal framing—when you buy material, you know you are buying good material—you do not have to examine it critically to see whether it is rotten timber or has windshakes, or any of those other things which come with the case of wood. Many people are not trying to find out what a steel car can do."

No response could be drawn from the irreconcilables to a request for them to formulate their objections so they could be answered.

Another committee was then appointed to report the following year, in 1898.

This committee, when it came time to report recommendations, begged to be excused, as only one member knew anything about steel car framing and they suggested that the report be deferred until more of them could have had actual experience.



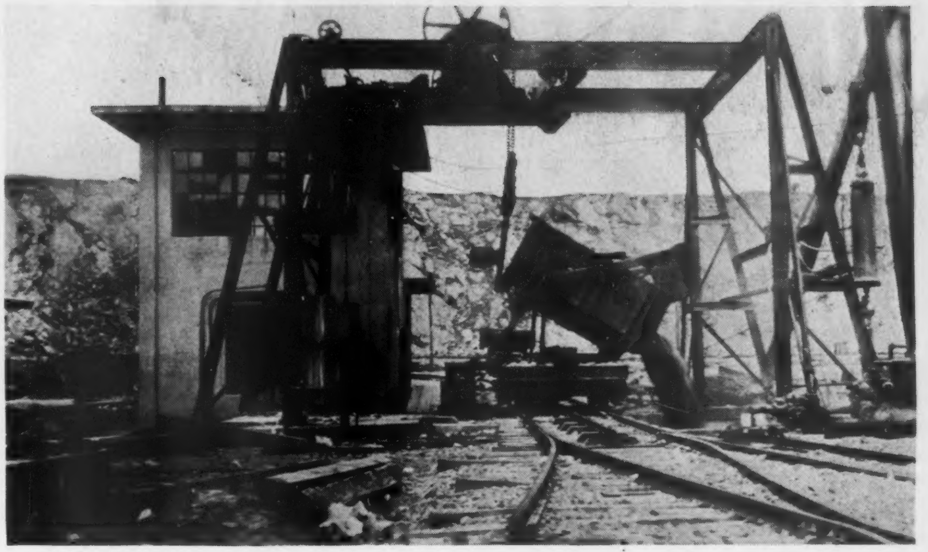
An example of progress in all-steel quarry car design

The replies to a questionnaire asking "what parts of a car should be of wood?" are interesting. They were as follows: "All except center sills." "All except end sills." "Any part subject to abrasion." "Doors, sides and ends only."

After much discussion it was recommended that the question be dropped and that four years later it be reconsidered by another committee.

Everybody knows what happened; not only the steel-frame car but the all-steel car had arrived to the everlasting glory of those early advocates of steel frames for wooden body cars, and of those courageous manufacturers who built all-steel cars while the wise ones were still discussing their merits.

This is an account of what really transpired 30 years ago, and while it is all about railroad freight cars, it is to a great extent typical of the situation and discussion now being waged in regard to cars suitable for present day demands in stone quarries. Ignorance or indifference concerning the maintenance costs of wooden quarry cars is "poor business," nor will the slight additional initial cost of a steel car over a wooden one deter the conscientious manufacturer from advocating the better car for this service.



New 10-yd. cars at the Verplanck plant of the New York Trap Rock Corp.

10-Yd. Cars Operated by Electricity

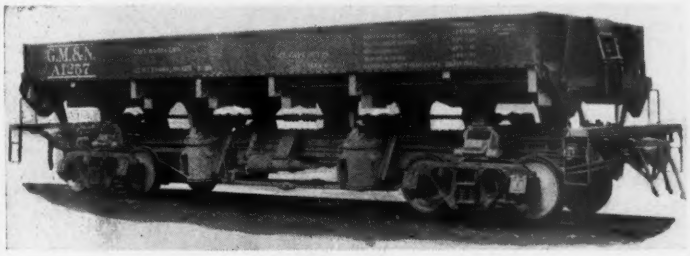
At the Verplanck's Point quarry of the New York Trap Rock Corporation there is an interesting installation of Western 10-yd. one-way side dump cars for quarry use.

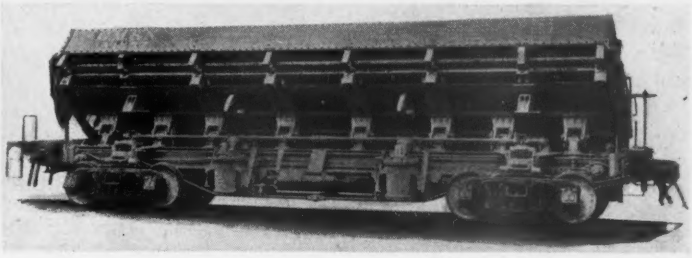
The Woodford Engineering Co. has equipped these cars with 37-hp. individual motors which take current from a third rail in the track system, according to the Woodford system of unit control.

The cars are built especially strong for quarry work with steel underframes and beds of 5-in. oak. The trucks are of a special design, considerably heavier and stronger than the regular 10-yd. two-way dump car. The dumping is air controlled from a source outside the car.

A 30-Yd. Car

The Koppel Car and Equipment Co. has just announced a new air-dump car of 30-yd. capacity with lift doors and drop sides which will doubtless find a use in some of the larger quarry and gravel pit operations.





A 30-yd. air-operated dump car for large operations and standard-gage railways

Trailers

The Miami Trailer-Scraper Co. has developed a new 4-wheeled all-steel, bottom dump trailer of 2½ tons capacity which may be found adaptable for quarry and gravel pit operation, with a tractor for power, in place of locomotives and cars.

This company also produced during the year an improved "one-man power" scraper which is equipped with roller bearing wheel equipment, greatly reducing draft and increasing the length of haul by increased operating speed. A hardened and polished sleeve is pressed into the hub of the wheel. This sleeve is easily replaced after long service. This unit is also regularly equipped with a high carbon steel blade or cutting edge. It has been found useful in some small gravel pit operations.

Two views of a typical new trailer for tractor units which may be used for stripping or quarry transportation

A new four-wheel trailer for general purposes

Conveyors, Elevators and Loaders

PROBABLY one of the most notable developments in belt conveyor practice is the rapidly increasing use of anti-friction bearings for pulleys and idlers. Most of the notable new installations have either roller-bearing or ball-bearing equipment. In this connection the Stephens-Adamson Manufacturing Co. states: "The year of 1926 has marked advancements in belt conveyor designs and construction. Correctly designed and well built belt conveyor installations are now being built to operate over greater distances at higher speeds and carrying larger capacities with new economy standards. Anti-friction pressure lubricated conveyor carriers contribute toward these new successes."

A good example of this progress in conveyor idler design is described by H. Crissey of the Robins Conveying Belt Co., as follows:

Troughing idler style 203-XD is unique in many ways. It is similar to other idlers in having threep ulleys equipped with Timken roller bearings whose advantages of design and construction are so well known as to need no comment. There are, however, different methods of applying these tapered roller bearings to idler pulleys. The adjustment of bearings for wear in the Robins idler is *entirely automatic* and cannot be tampered with.

It has been demonstrated through years of experience that cast iron is the most durable material for idler pulleys and this idler pulley is of cast iron with closed ends and rounded corners. The closed ends prevent dirt from gathering in the pulley. The rounded corners prevent possible injury to the conveyor belt at the point of bend between center and side pulleys. Danger of damage to the belt at this point is further reduced by making the gap between edges of pulleys as small as possible.

Each of the hollow steel shafts on which the idler pulleys revolve is firmly supported in a fixed position at each end, assuring perfect alignment of bearings and preventing uneven wear. To each end of each pulley shaft there is rigidly fastened a "bracket block" which fits into a socket in the main idler bracket. This design makes it possible to lift out and replace any idler pulley with its bearings, shaft and bracket blocks without the use of tools.

The three pulley outfits for any size of idler are identical in every detail and, therefore, interchangeable. The idler brackets are of cast iron with smooth surfaces that do not present pockets or hollows for the accumulation of dust and dirt. After the pulley outfits are slipped into place on the brackets there are cotter pins inserted in the tops of brackets above to hold the pulley outfits in place during shipment and erection. After the idlers are in place on the conveyor structure these cotter pins are unnecessary and may be discarded if desired. The idler "board" to which the brackets are bolted is made of a standard steel angle set with its apex up so that any dirt falling on the idler board will be spilled off the sloping sides and cannot pile up under the pulleys. At the ends of this angle board there are castings to which the angle is bolted and which form the attachment to the structure. These castings are marked to indicate the proper position of the idler in reference to the direction of belt travel.

The high pressure grease fittings for lubricating the roller bearings are located at the ends of the idler board in a position plainly visible and easily accessible, but not projecting so as to be broken off or damaged. The attendant in greasing the idler is in no danger of contact with the moving belt or idler pulleys. The grease from these high pressure fittings is carried by concealed and protected pipes to the grease reservoir of each pulley and provides positive lubrication for each bearing. Each bearing is protected at its outer side by a double grease seal consisting of two felt washers and two steel cages which prevents dirt from getting into the bearing or grease from getting out.

New Pan Conveyor

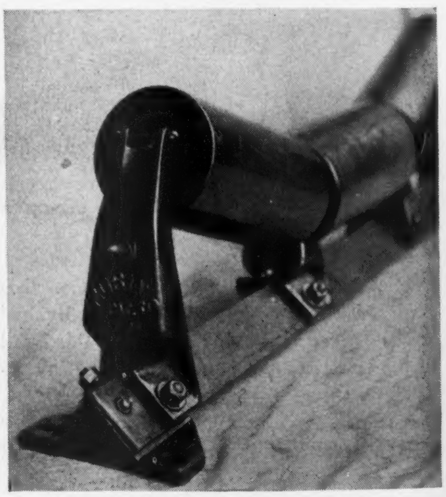
The Allis-Chalmers Manufacturing Co. announces the completion of the design of a 30-in. pan conveyor, which now gives this company a complete line of this type of equipment. It now has pan conveyors to accompany its line of bucket elevators with standard widths of 30, 42, 60 and 72 in.

Loaders

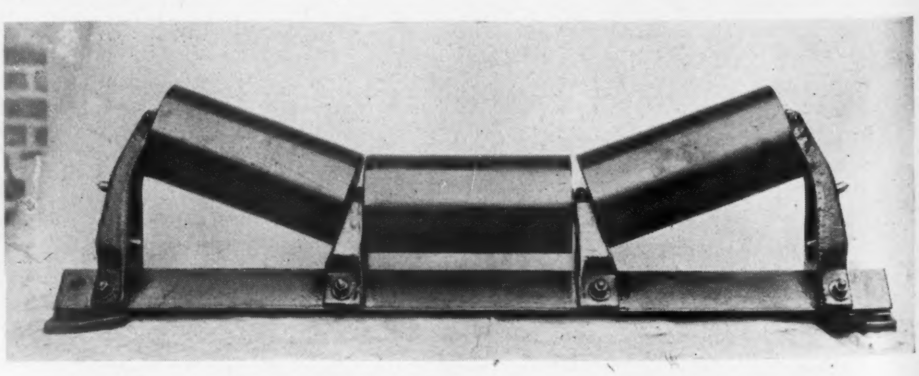
During the year we described new portable loaders of the elevator type by the Link-Belt Co. and the Barber-Green Co. and a loader of the conveyor-belt type by the Jeffrey Manufacturing Co.

An interesting and unusually large installation of a portable belt conveyor for placing mixed concrete is illustrated herewith. The Northern Conveyor and Manufacturing Co. describes this installation as follows:

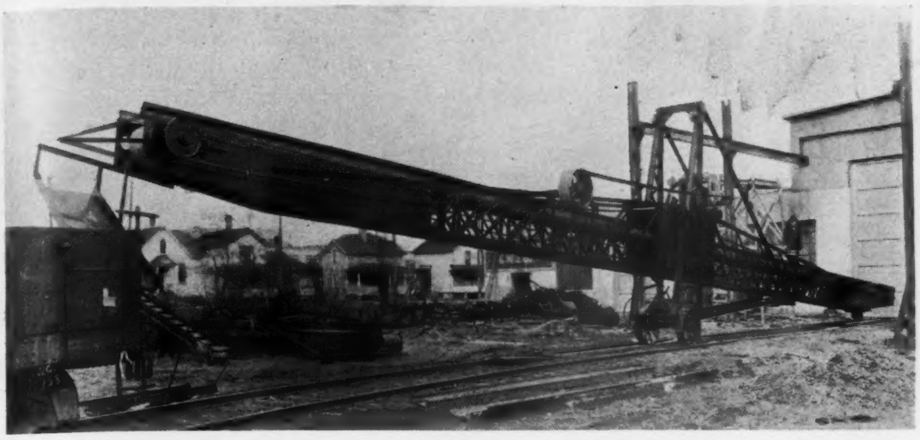
"The capacity of the unit is fully 300 tons per hour and it consists of a 30-in. belt width



The latest in troughing idlers for belt conveyors



Another view of the new roller-bearing idlers



A very long portable belt conveyor used for handling mixed concrete

of steel frame conveyor trussed top, bottom and sides and 80 ft. in length. The conveyor is balanced at a point 27 ft. out from the loading end, at which point it is hung by steel cables to a portable truck of four wheel design mounted on railroad rail.

"The conveyor is adjustable in height and the movement of the truck carrying it is controlled by a gear reduced hand winch.

"The conveyor boom itself rests on these steel cables 36 ft. in the air without supports at either end and in this position handles concrete delivered to it with steel industrial cars carrying it into the forms."

The weight of the complete unit is about 19,000 lb. Power is furnished by a 20-hp. "Red Seal" Continental motor.

Another remarkable portable belt conveyor, known as a "stacker," is described by F. M. Welch, chief engineer of the Greenville Gravel Corp., as follows:

During the past year we designed and installed quite extensive local trade bins in what is known as our Ford road yard at Detroit, Mich. The general arrangement of the plant consists of a long row of bins over the top of which nearly a whole train of hopper bottom cars, loaded with washed and screened gravel from our Brighton plant, is spotted and dumped. Underneath these bins hundreds of trucks pass every day, receiving their load through bin-bottom gates and delivering gravel, sand and various commercial mixtures over the city.

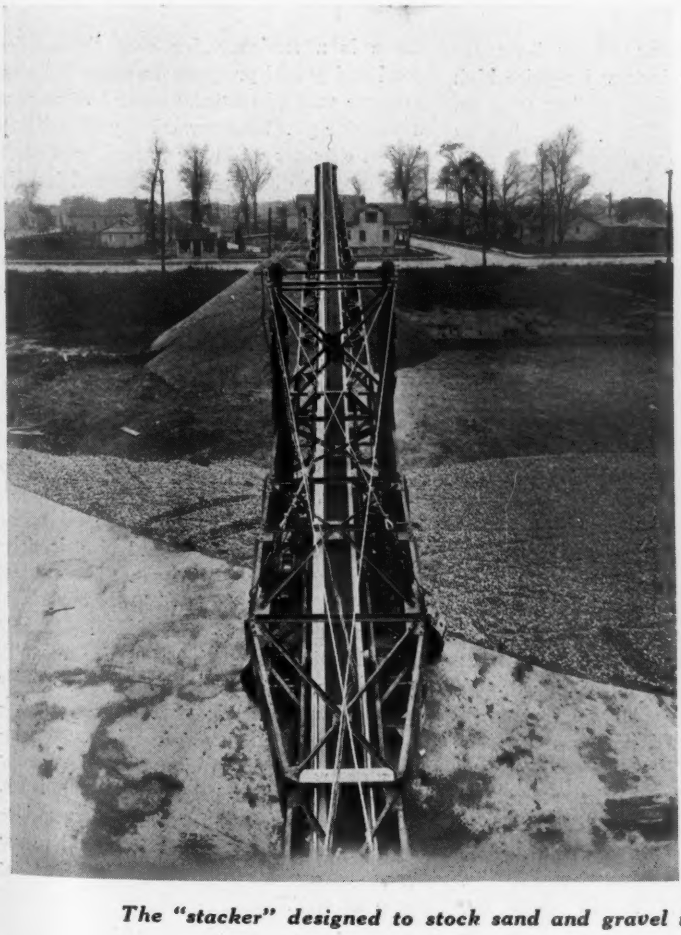
During the busy construction season the material is hauled away as fast as it is received. During the early spring and late fall, however, a surplus accumulates which requires further storage facilities. This auxiliary storage is further necessary to take care of the ever increasing winter trade after the gravel washing plants have closed down.

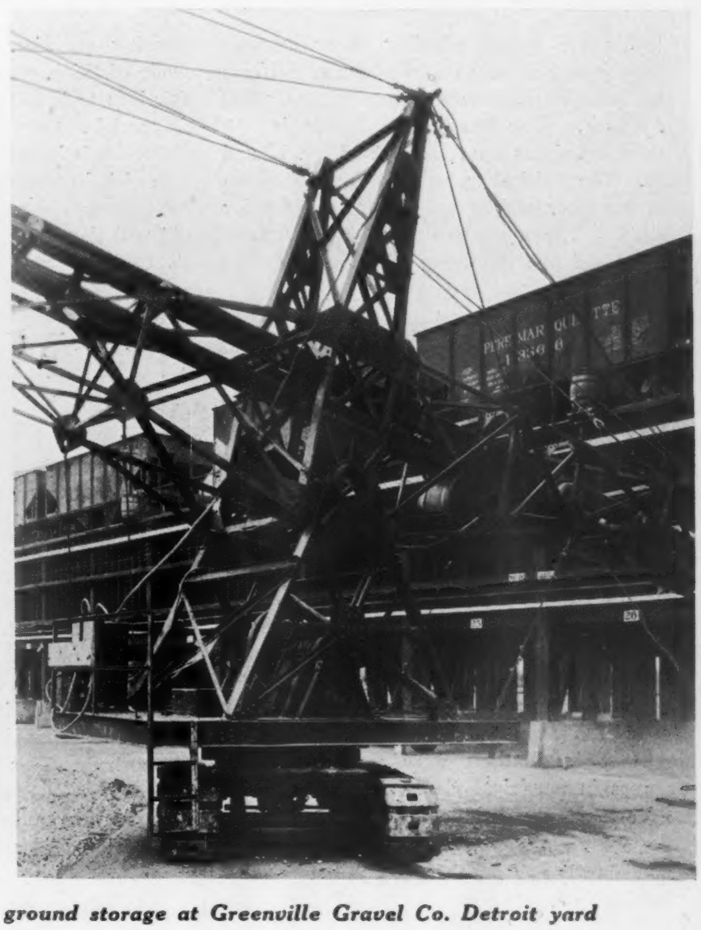
Our property contained sufficient acreage to permit ample ground storage adjacent to the long row of bins. The problem was to conceive a storing and reclaiming unit which would relieve any one of the bins, transferring the surplus to any part of the yard and which later on could reclaim the ground storage and replenish certain of the bins which were equipped with steam coils to keep the material properly thawed out and heated for winter use. The accompanying drawings and illustrations show best how it has been successfully accomplished with a unit which we designed and built ourselves and which we call our stacker.

The unit consists of a 24-in. belt conveyor 126 ft. long running at 450 ft. per minute and mounted on a structural steel boom. The boom is pivoted, 40 ft. from the feed end on a standard model B-2 Erie caterpillar type revolving shovel base. The short end of the boom is counterweighted to balance the 80 ft. cantilever of the discharge end. The belt conveyor, the propelling machinery for the caterpillars and the rotating gears are all electrically driven. The tilting mechanism which requires very little power is hand operated through a worm gear.

With the portability, the rotating and tilting features the absolute flexibility of the unit is assured. When reclaiming in the winter a standard Barber-Greene loader is used to pick up the material from ground storage and feed it into the receiving hopper of the stacker.

The Ford road yard described above, which also handles cement and other building ma-





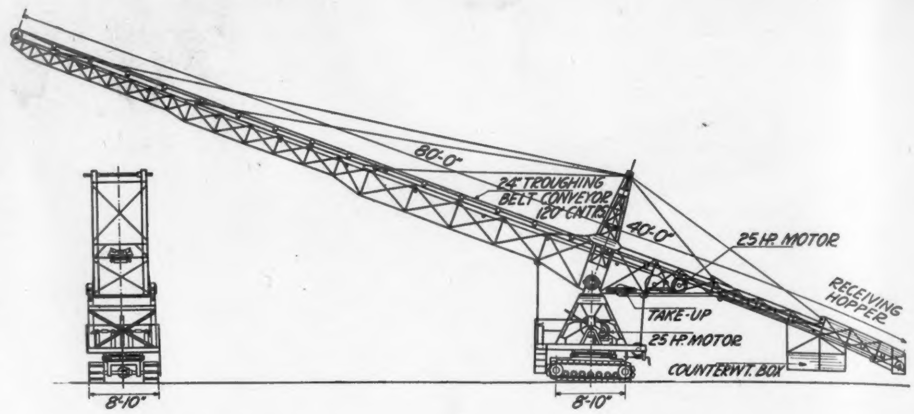
The "stacker" designed to stock sand and gravel in ground storage at Greenville Gravel Co. Detroit yard

terials in large quantities, is operated by the United Fuel and Supply Co. of Detroit.

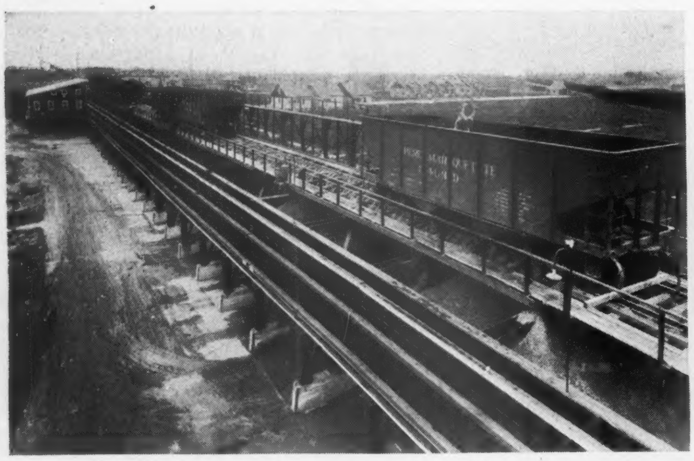
Belting

Progress is constantly being achieved in the manufacture of fabric belting for both conveyors and drives. During the year there have been made in the rock products industry some very notable installations of "Fabreeka" belting, an improved fabric belting, which is described as follows:

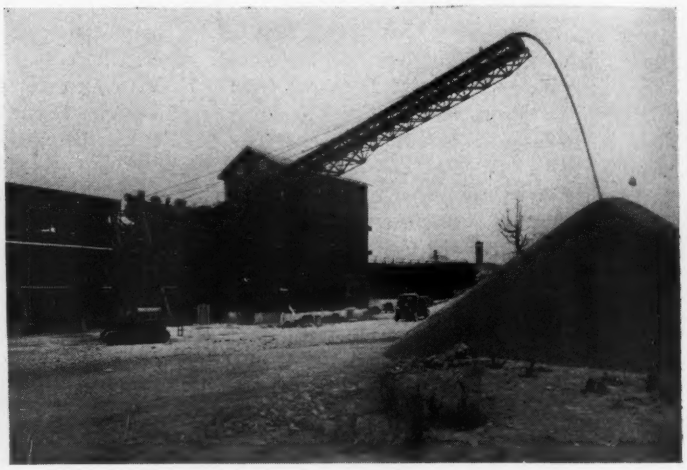
"The basis of Fabreeka is a thin cotton fabric of special cotton tightly twisted and closely woven. This fabric must test 145 lb. per inch of width before acceptance. Each layer of this fabric is treated with a special compound and then a number of layers are welded together under extreme tension and pressure into a dense, uniform material 48 in. wide and approximately 600 ft. long. The number of layers in the several weights are 3, 5, 7, 9, 11, 14, 17 and 21. The finished material is then cut down to narrower widths and shorter lengths for stock. The compound used was specially developed and is largely responsible for its wearing qualities. Some rubber belts are made of thick, coarse duck and require high frictions to keep the plies together as much as possible. Only in such a 'thin-ply' belt as Fabreeka is it possible to use a low friction. The friction increases in strength as the belt grows older, so that a belt five years old will show several pounds higher friction than when it was new."



Side elevation of the Greenville Gravel Co. gravel "stacker"



The "Greenville" stacker in action taking gravel from bins



The Greenville Gravel Co., Detroit, receiving bins

Pumps and Dredge Machinery

NO very radical changes have been made in the centrifugal pumps, especially in the rock products industry, except the rubber-lined pump and cutless rubber bearings for pumps handling abrasive material, which will be fully treated in a special article in a later issue. In water pumps the Allis-Chalmers Manufacturing Co. has made a considerable advance in developing the new high efficiency "S" pumps and a line of double suction multi-stage pumps which they are putting on the market. Several important installations were made of these pumps in municipal plants and the like but none in the rock products field. The use of these high efficiency types of pump would undoubtedly pay for their cost in many cases in this field.

Largest Diesel-Engine Dredge

The Bucyrus Co. is at present building for delivery about the middle of the year 1927, the world's largest Diesel-electric hydraulic dredge. This machine will be equipped with four 1150-hp. Diesel engines with two auxiliary engines of 60 hp. The cutterhead is 8 ft. in diameter, while the discharge line is 30 in. Probably the most striking feature in the design of this dredge is that the cutter head is driven by motors capable of developing 900 hp. for the period of one hour. This is considerably in excess of the horsepower applied to the cutter head drive on any other hydraulic dredge for which the information is available. The pump is driven by a motor rated at 3,000 hp.

The Morris Machine Works notes that there is a tendency for even the smallest sand and gravel producer to use a pump and produce washed material instead of working a wayside pit. Since practically all sand and gravel deposits go below ground water level it is easy to dig a pit to water and install a pump, at first on the land and later, as production increases, to place the pump on a dredge. Some of this company's recent installations of pumps for this kind of an operation have proven very successful.

This company writes regarding power from driving pumps for dredging:

Electric Drives Most Popular

"Electricity is by far the favorite drive at present. Where electric current is not available, the tendency is to use oil engine drive for the main unit and electric drive for the auxiliary equipment. The current for the auxiliaries is furnished from a generating set on board the dredge. On very small installations such as require about 50 hp. or less, the tendency is to use gasoline engines when electric current is not available. Steam is used very rarely on new installations, except in the case of lake or ocean-going hopper dredges or sand boats. Where steam is used for propelling machinery this, of course, makes it logical to use steam power for operating the dredging pump as well."

Special Gasoline Motor for Pump Drives

The Climax Engineering Co. has developed a service pump drive for use where its engines are used for driving dredge pumps. This drive is a convenient pulley on the engine shaft from which a belt may be run to a pump for furnishing pressure water for the gland of the dredge pump to protect the packing. The company notes that it has added this feature as so many of its engines are now being used for driving dredge pumps.

A prominent operator says that the best service pump he has found for furnishing pressure water to protect the dredge pump packing is a small piston pump driven by a belt on the pump shaft. The pipe from this pump to the dredge pump gland is furnished with a tee and branch which is fitted with a valve. This valve is closed back until the proper pressure is given to the packing.

The Hill Clutch Machine and Foundry Co. notes the use of their "step-ups" or speed transformers to connect oil engines with centrifugal pumps, especially dredge pumps. Three installations of this kind are reported. One was 80 hp., one 100 hp., and one 120 hp.

The Krogh Pump and Machinery Co.'s new full-lined sand pump was described in the July 24 issue. It has an adjustment by which the clearance may be taken up to keep it normal. A portable gasoline pump and engine, handy for temporary work, with a capacity of 20,000 to 30,000 gallons per hour was described in the September 24 issue.

Geared Speed Reducers

IN probably no branch of the machinery and equipment field of rock products manufacture has more progress been made than in the adoption of geared speed reducers, and in the design of speed reducers, for direct-motor-drives. In our Annual Review and Directory issue of 1925 we published an elementary discussion of types of reducers, so here we shall discuss their applications on the assumption that readers are familiar with the various types.

Worm Reducers

One of the most popular and generally applied types of reducers is the worm-gear. As now manufactured with special frictionless bearings, the Cleveland Worm and Gear Co. states that the efficiency of this type of reduction unit is only exceeded by exceptionally well-made herringbone speed reducers. The accompanying chart shows the guaranteed efficiencies of this company's reducers at various ratios.

This company manufactures two general types of speed reduction units; one of which is designated as type "AT" unit and the other as the type "AH" unit. The mountings for the worm shafts, in each type of unit, are similar, the thrust being taken by heavy duplex bearings and the radial load at the other end carried in a heavy-duty radial ball bearing. The gear shaft mounting, however, is quite different.

The gear shaft of the type "AT" unit is mounted in Timken tapered roller bearings, these bearings having sufficient thrust capacity to absorb the gear thrust and also to carry the radial load. They are not, however, designed for overhung loads on the gear shaft and this unit is, therefore, designed for direct connection to the driven machinery. The general line of units of this design is designated as type "AT" but, as a matter of fact, the line incorporates two styles of unit, the type "AT" having the worm located below the gear and the type "RT" having the worm located above the gear, which is not so common.

The other general type of reduction unit designated type "AH," differs from type "AT" in the gear-shaft mounting. The gear shaft of this drive is mounted in heavy-duty Hoffman radial roller bearings and that the gear thrust is taken by single-row roller bearings. This mounting, together with the heavy nickel-steel gear shaft permits placing a sprocket, gear, or belt pulley directly on the gear shaft extension without the use of an outboard bearing.

In addition to these two types, the Cleveland Worm and Gear Co. manufactures vertical worm gear reduction units, but these are not used, to any great extent, in rock products plants. Double reduction units to give very high reduction in speeds are also a part of its line, but are used in rock products plants only occasionally.

Typical Installations

The De Laval Steam Turbine Co. specializes in worm gear reducers and has made some notable installations in the rock products industry in 1926. This company states that worm gear reducers are being extensively adopted for driving moderate speed or slow speed machinery such as large centrifugal pumps, blowers, fans, conveyors, hoists, rolls, washers, crushers, screens, etc., where there is a speed reduction ranging from 4 to 1 up to 8000 to 1, and where the power transmitted does not exceed about 500 hp.

For lower speed ratios in small or moderate powers, the helical type of gear illustrated herewith, is applied, while for large powers, the double helical type of gear is employed.

The greatest application in the cement and rock products industries is of worm gears in driving conveyors, but they are also extensively used on pulverizing mills, kominuters, screens, fans, coolers and dryers.

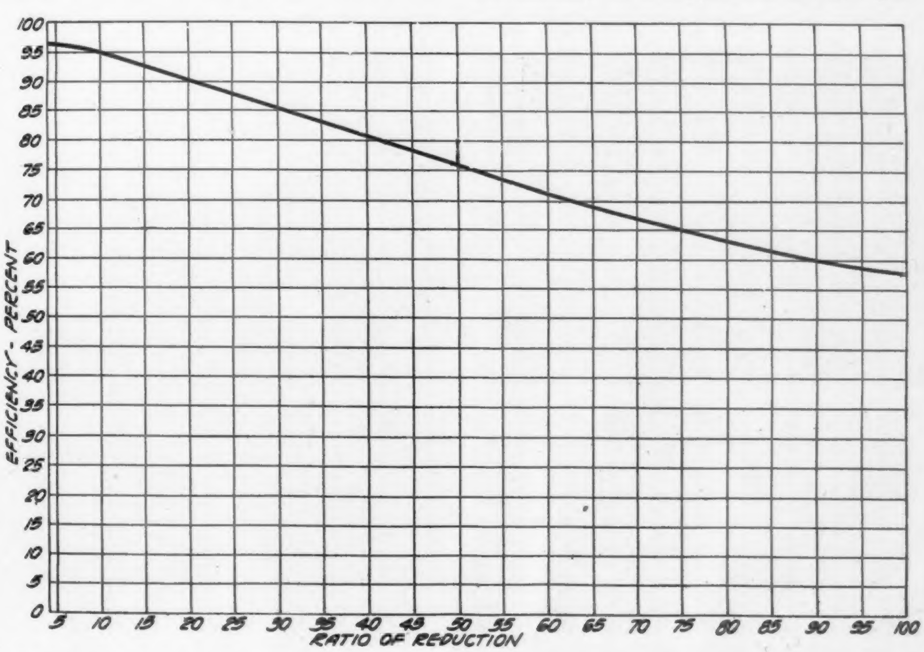
Some typical installations of De Laval worm gear reducers in the rock products industry are shown in the accompanying illustrations on the following pages.

Much Difference Between Old and New Worm Gears

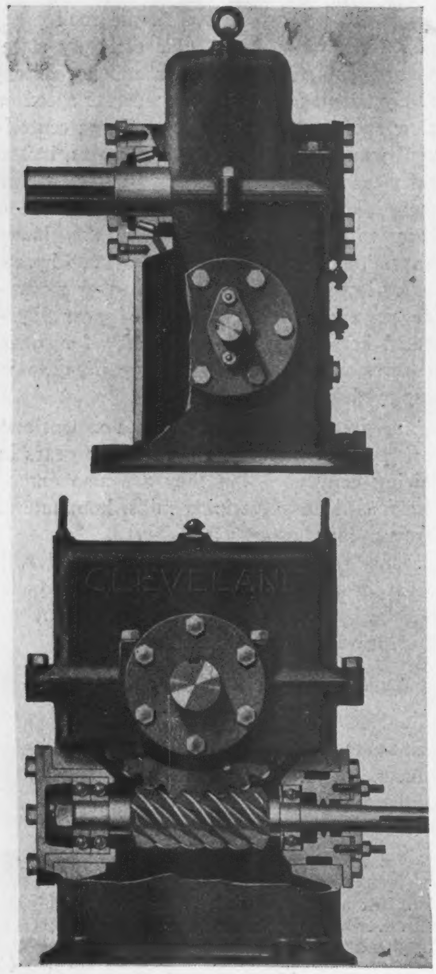
In a general discussion of all types of gear reducers C. G. Wennerstrom, of the Foote Brothers Gear and Machine Co., refers to worm-gear reducers as follows:

"The worm gear type of reducer has been and is still considered by many as a very inefficient and unreliable means of speed reduction, but recent investigations have brought about improvements in design and manufacturing methods that have resulted in the development of distinctly modern and effective worm gear reducers to meet the exacting conditions of modern industrial service.

"These developments have brought the modern worm gear reducer into a class of high speed, high efficiency and high power transmitting capacity, but the simple, compact construction is retained and makes it an ideal drive where space is limited and where the power has to be transmitted at right angles. The efficiency of this type is almost on a par



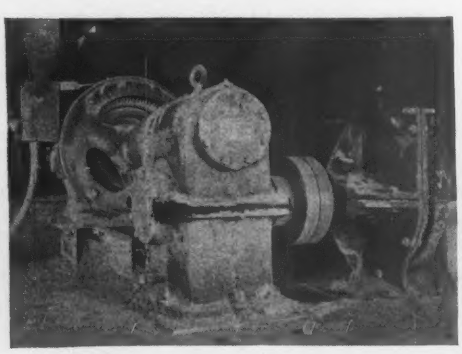
Guaranteed efficiencies of a modern frictionless-bearing worm gear speed reducer



Ordinary type of reducer not designed for load on gear shaft without outboard bearing to sustain it

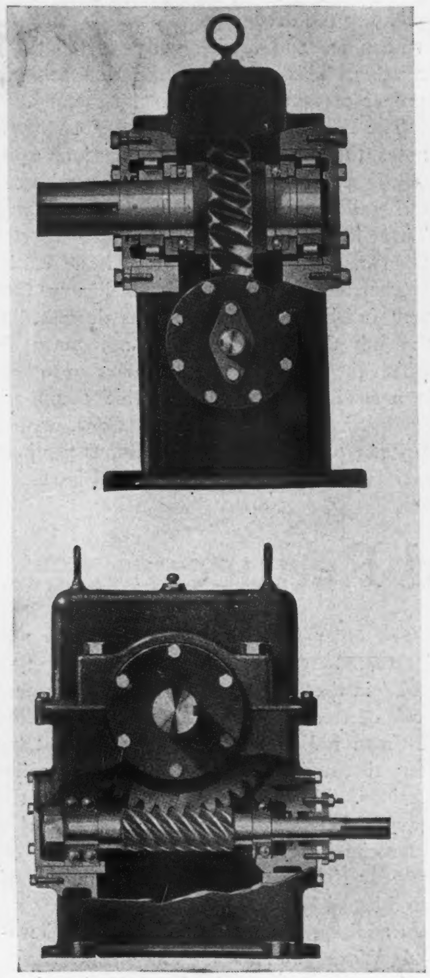
with any other type of reduction unit and at certain low ratios, the efficiency is even greater than the spur type and bevel gear reducers. Due to the simplicity of design and its adaptation to any kind of position and installation, the high efficiency worm-gear reducer has found a wide popularity.

"From an economcal standpont, worm-gear



Drive of long belt over packers, Sandusky Cement Co. plant

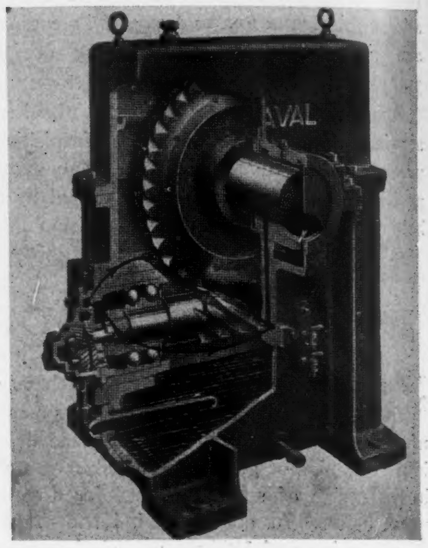
reducers can be divided into two groups; one group is the original development usually equipped with commercially-cut worm-gears and worms made from some fairly high-carbon steel and keyed to a worm-gear shaft. Bearings are usually plain sleeve bearings and depend upon lubrication from the splash of the worm and worm-gear. Although, perhaps, it appears to be antiquated type of



The same reducer with heavy shaft bearings to permit such an overhanging load as a pulley on gear shaft

equipment, it has nevertheless a wide application as a cheap and dependable unit with higher reductions in intermittent and temporary service where the power transmitting efficiency is of no importance. It gives good results on the slow speed end of extremely high reduction, it is a useful timing device as a combination of a few worm-gear ratios would give very high reduction with comparatively few parts. It is indispensable on many hoists and elevators on account of self-locking properties on high ratios.

"In the second type of worm-gear reducers, already referred to, all unnecessary friction is eliminated in the shaft bearings by incorporating ball and roller bearings to take care of radial and thrust loads on the worm and worm gears. Thus the efficiency of these units is exceptionally high.



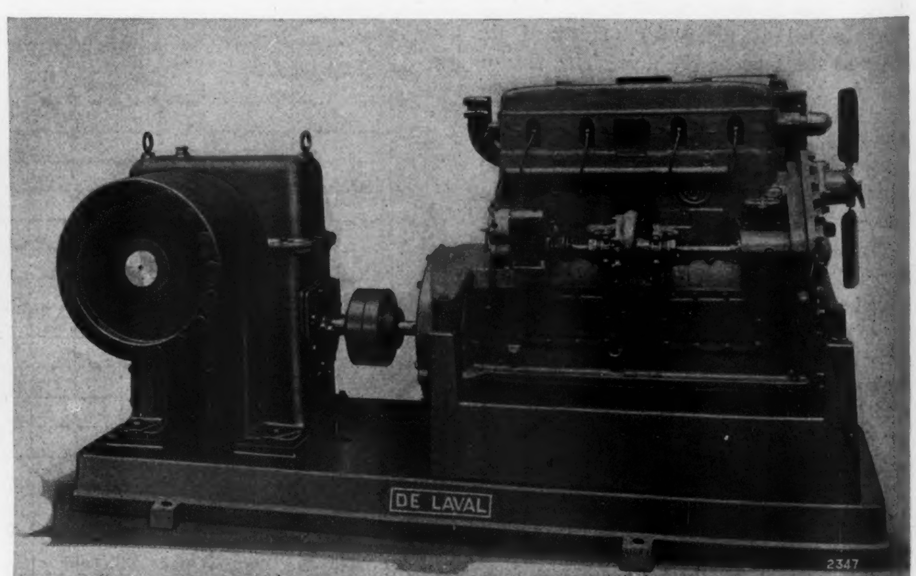
Showing construction and pressure oiling system of worm gear reducer

"Great care is necessary in the tooth design and specially designed manufacturing tools and equipment are necessary to insure extreme accuracy in the production of worm gears and other parts.

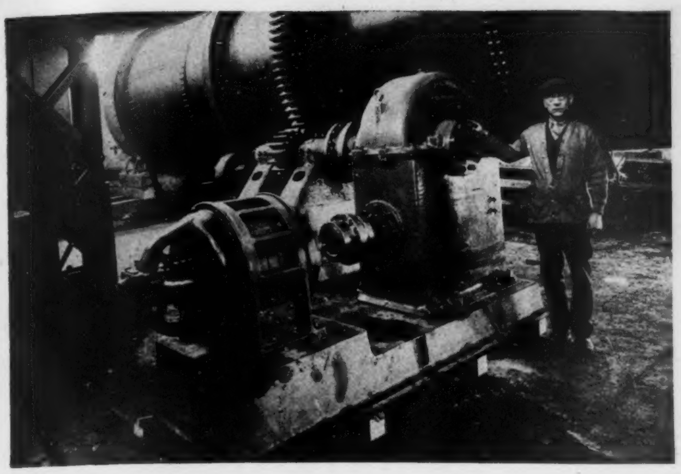
"Maximum results are only secured through the use of highest-grade materials carefully selected. This, together with close attention to manufacturing processes, insures perfect tooth contact and extreme quietness in operation without vibration."

Special Alloys and Steels Used

One of the worm-gear reducers placed on the market in 1926 by the William Ganschow Co. is described briefly as follows:



Worm gear installed for belt drive of a fan from gasoline engine



Worm gear drive on dryer, 19 2/3-1 ratio, assembled for shipment to Africa

Screen drive, Lake Erie Limestone Co., 21 1/2 to 1 worm gear reducer

Standard units are equipped with a special bronze gear. The physical properties of this special bronze prove it to be superior to the commonly used phosphor bronze inasmuch as it has a 50% greater load-carrying capacity.

The gears are generated on a tangential feed-hobbing machine to an absolutely correct tooth form and accurate index.

The face width of the gear is designed so that the unit pressure load is much below the safe working stress of the metal. The smaller units have a solid bronze gear. The larger units have a bronze rim shrunk and studded on a cast-iron center.

The design of the worm is such that the very highest efficiencies are obtained. Rolling contact has been increased to a maximum and sliding contact to a minimum. Consequently, attendant cutting at high speeds and on heavy duty is eliminated.

Nickel steel (3½%), S. A. E. No. 2320, is the material specified for worms. Properly carbonized and hardened this is claimed to be an ideal worm steel. The casing on the worm threads is 80 to 85 scleroscope hard, while the center core is very tough and of high tensile strength. The worm is completely ground. The worm threads are ground to correct straight side axial form and to accurate index.

The pressure angle of the worm thread is 22½ deg. on the axial section. Anti-friction thrust bearings are used throughout. Either ball or roller bearings may be fitted to these units according to the service demands.

A 17 1/2 to 1 worm speed reducer driving 42-in. continuous bucket elevator

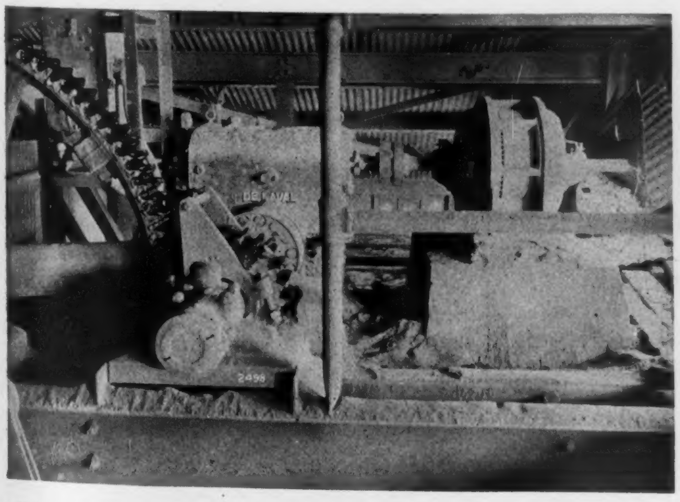
A new worm-gear reducer by Horsburgh and Scott was described in ROCK PRODUCTS, April 17, 1926.

Spur-Gear Reducers

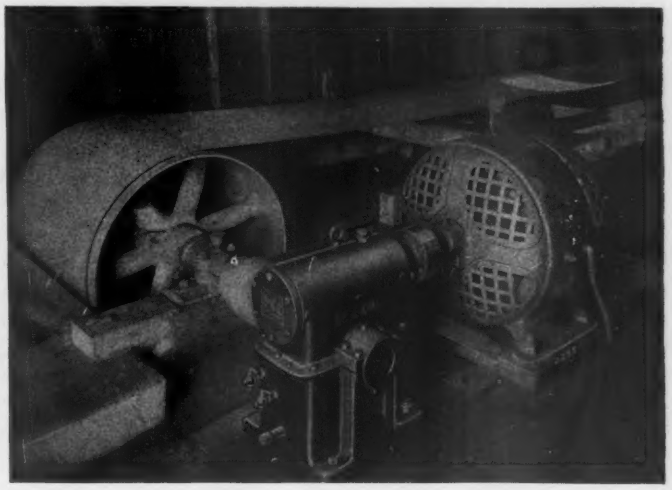
In his general discussion of geared speed reducers, already quoted from, C. G. Wennerstrom, of the Foote Brothers Gear and Machine Co., states the advantage of their spur-gear type of reducer is "a small and compact unit with comparatively small gears.

"When hardened and heat-treated gears are used in spur-gear reducers, the power transmitting capacity is generally about the same as that of an electric motor of the same rating to which it may be connected, although the torque ratio of the high and low speed shafts will run very high in most cases. This is a great advantage when space is valuable and a combination of an electric motor with a reducer of this kind makes a neat and efficient installation wherever shafts are to be direct-connected in line by flexible couplings. The speed at which spur-gear reducers are operated should not exceed speeds recommended by the manufacturers, as the types of gears, and the combination of the gears used does not lend itself to speeds above ordinary electric motor speeds. For sizes of 25 hp. or more, moderate speed motors are preferable. High speeds will produce excessive heating and in many instances undesirable noise and vibration."

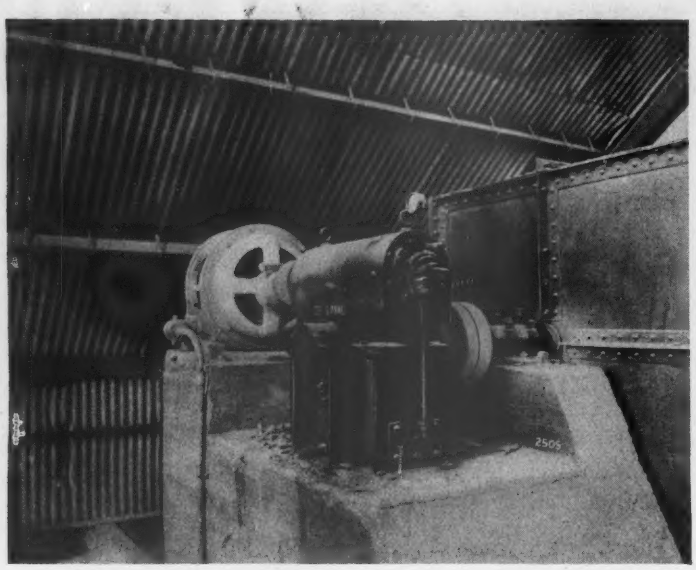
The Palmer-Bee Co., which has made a large number of installations of spur-gear reducers in the rock products industries, re-



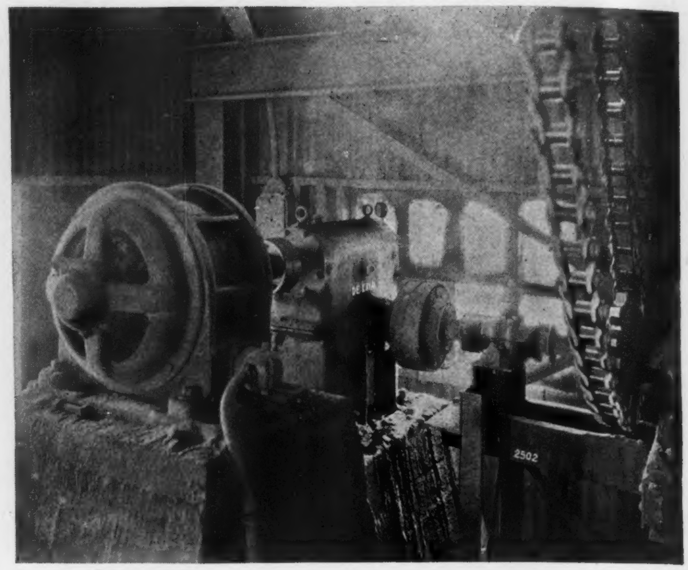
Worm gear reducer driving bucket elevator in a very gritty situation



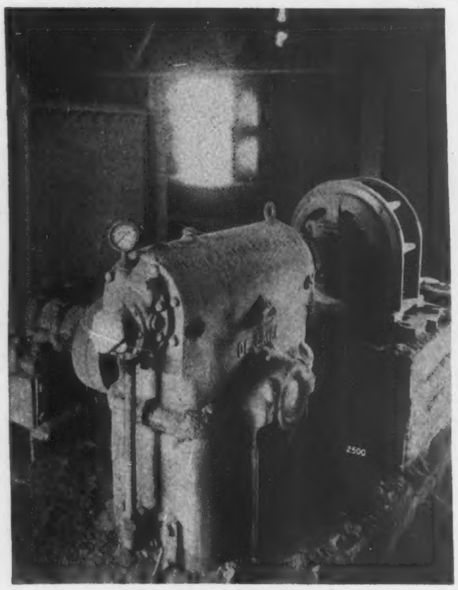
Motor driving belt conveyor through worm gear reducer of 25 to 1 ratio



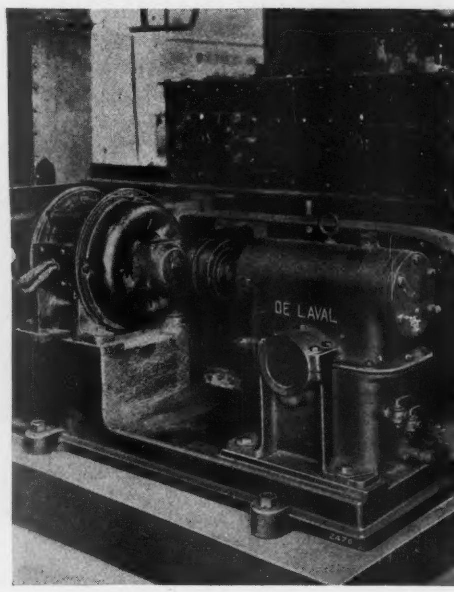
Motor driving elevator through 24 1/2 to 1 worm gear reducer



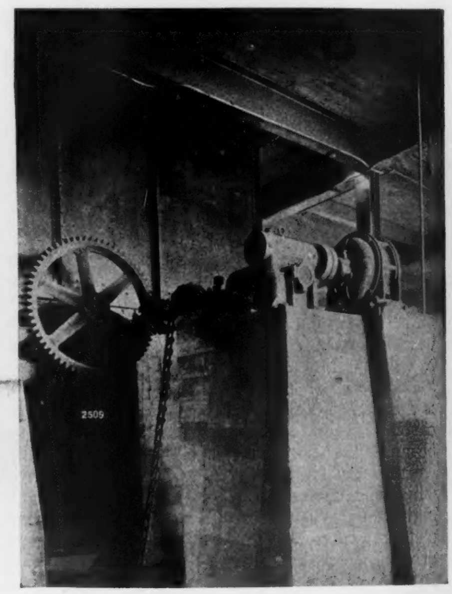
Motor driving elevator and screw conveyor through worm gear reducer and chain



Worm gear reducer especially adapted for elevator drives

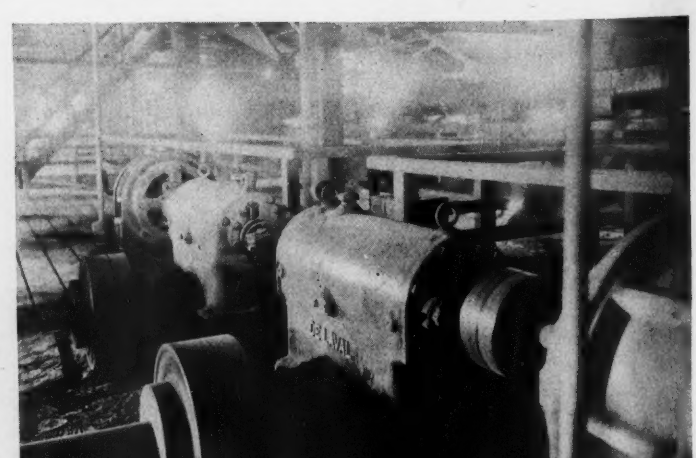


Motor driving a coal crusher through 7 1/ to 1 worm gear reducer



Drive on a bag cleaner with 19 1/2 to 1 worm gear reducer

Motor with 17 1/2 to 1 worm gear reducer reversing a gas valve

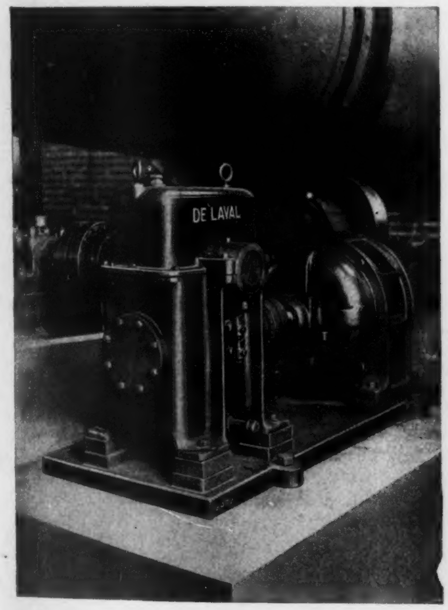


Drag conveyor driven by a 20 to 1 reduction gear speed reducer

cently announced an improved machine, which is described thus:

"All the good features of the old style reducer have been retained in the design and construction of the new type. The fundamental principle, which has been proven correct through years of the most gruelling service, is the same. But, as a result of experience in practically every basic industry in the country, these changes have been made which add materially to the ruggedness and simplicity of this unique reducer: gears are cut from forgings of special analysis steel, or from electric steel castings; pinions are cut from high carbon steel; bushings in all bearings are of high-grade phosphor bronze and are interchangeable; improved grooved joints make the reducer absolutely oil-tight and dust-proof. No shellac, felt washers, end plates or other means of retaining oil are necessary; steel set collar, shrunk on slow speed shaft inside of casing, protects gearing from external end thrust."

The Hill Clutch Machine and Foundry Co., which specializes in spur-gear reducers, lists a number of typical installations in the rock products industries in 1926, as follows: Kirkpatrick Sand and Cement Co., 5-hp. unit driving bucket and chain elevator; Wadsworth Brick and Tile Co., 10-hp. unit driving elevator; Haywood Williamson, 80-hp. step-up drive direct connecting to oil engine to dredge pump; W. D. Hayden Co., 100-hp. step-up on drive direct connecting oil engine to dredge pump; Standard Portland Cement Co., 10- and 15-hp. units driving screw conveyor and bag cleaner. Two of these installations are of particular interest as they show the general term "speed reducer" is a misnomer, at least in the sand and gravel industry, where an important use of speed *transformers* is to increase the speed of oil-engine drives for dredge pumps.

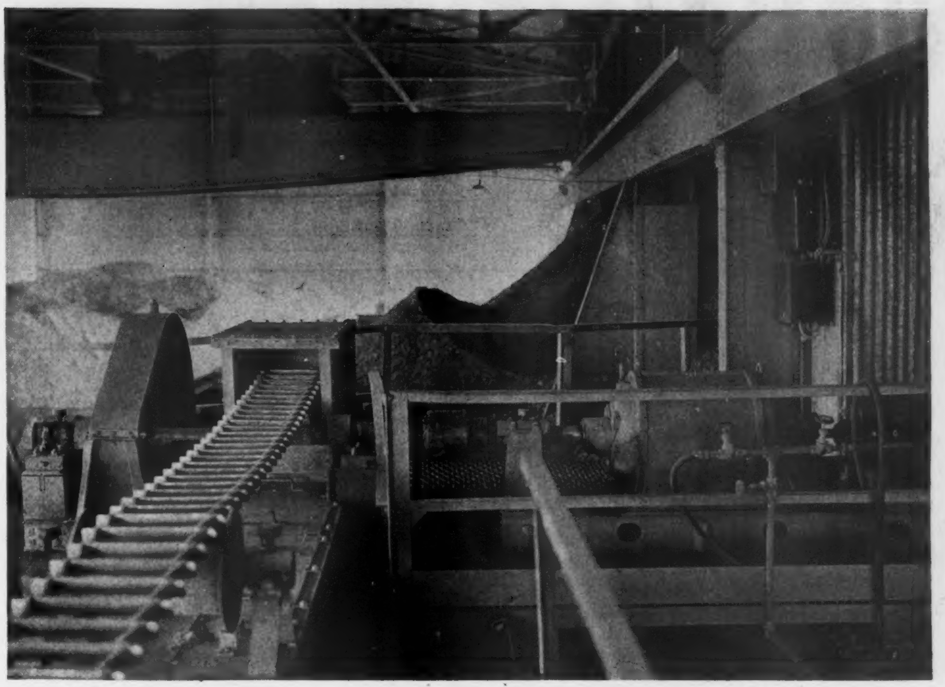


Worm reduction gear on dryer drive, 6 1/5 to 1 ratio

Some illustrations of the Hill speed transformer used in these installations are shown herewith.

Herringbone Gears

We believe the herringbone type of speed reducer was originally developed for driving ships from high-speed steam turbines. It has only recently been used in the rock products industry for drives on very heavy units.



Drive of drag conveyor over clinker storage through speed reducer and chain

The D. O. James Manufacturing Co. has just announced a new continuous tooth herringbone speed reducer for the rock products industry, described thus:

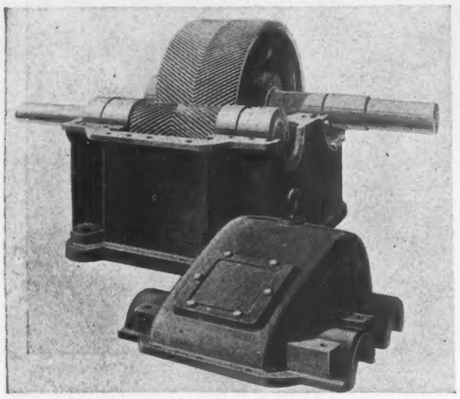
"In this reducer the herringbone gears embody the double helical principle, giving a result similar in appearance to the joining of two single helical gears having opposed helix angles. Thus each individual tooth is brought to an apex and has the shape of a completed "V," the tooth being in no way broken and the apex not rounded to provide for tool clearance, as in the common herringbone tooth gear with the gutter down the center. The minimum loss of face width from either the gap or rounded apex is equal to the circular pitch. James herringbone gears gain this amount in face width.

"The individual tooth is generated with a curve or twist which comes in to present the same profile in the normal (right angles

Worm reduction gears which replaced belt drives for an 11 2/3 to 1 ratio

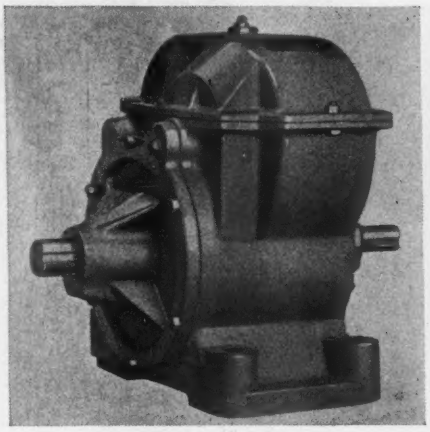
to the helix angle) and to the diametral (right angles to the face) planes of the gear. This denotes the accuracy of the tooth in every respect and is made possible by a special gear generator and cannot be accomplished by the old style of hobbing process of cutting herringbone gears.

"The teeth are cut involute with 20 deg. pressure angle and 30 deg. helix angle with an addendum of 0.8 over the D. P. and a dedendum of 0.1 over the D. P. This cutting at a helical angle of 30 deg., heretofore thought not easily obtained, with the tooth coming to an apex, results in the neutralization of end thrusts in the teeth. End thrusts are the chief objection to single helical gears. The above feature of herringbone gears, especially of the James type, makes an overlap of approximately 50%, or approximately 50% greater number of teeth in contact at one time. (Complete overlap is obtained when the face width is equal to or greater than 3.47 times the circular pitch.) This overlapping makes the action continuous, smooth and noiseless, because there are no shocks when the load is given from one tooth to another succeeding one.



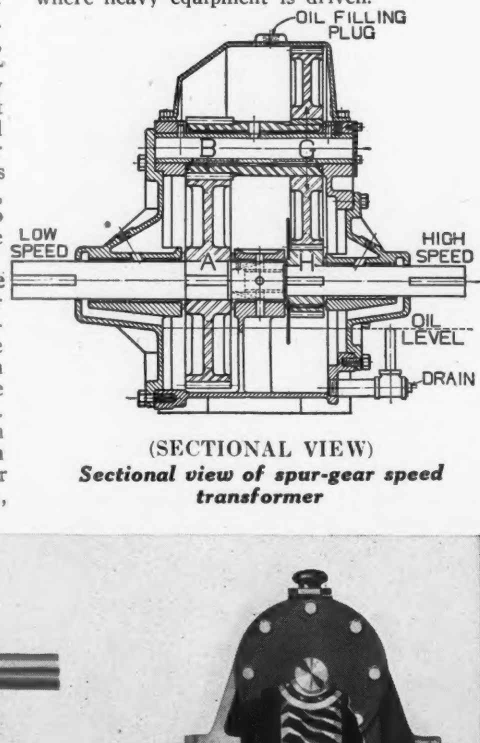
Continuous tooth herringbone speed reducer

"There are two teeth always in mesh in the plane of axis. The teeth are of greater strength, having a double angle and allowing for the load to be distributed over the full width of the tooth. Consequently with the herringbone gear great loads can be carried by small gears with high efficiency. This leads to a number of features, such as greater reduction ratios and high rim speeds (several teeth safely meshing), longer life (less shock vibration and friction), less power consumed and less space required because fewer gear reductions are necessary. Also backlash and play are practically eliminated. All of these characteristics have special application to speed reducers and were influential in causing the James company to adopt the type.



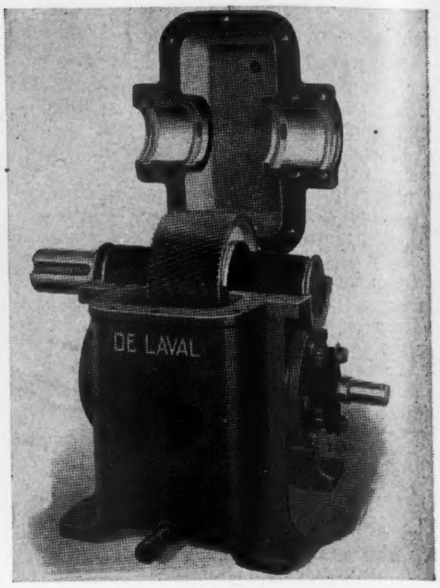
Spur-gear speed transformer made both to increase and decrease speeds

"The James company is now manufacturing reducers, using herringbone gears, for reduction ratios from 2 to 1, to 150 to 1, and able to carry loads of 2 hp. to 200 hp. These reducers are made to fill the demand for heavy, rugged, durable types, especially where heavy equipment is driven."



(SECTIONAL VIEW)

Sectional view of spur-gear speed transformer

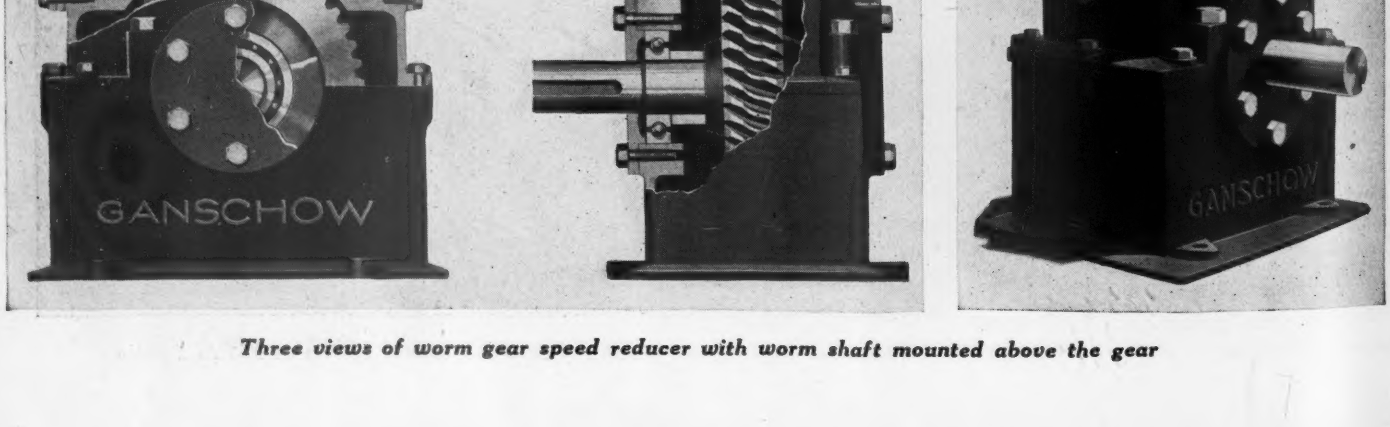


Cover lifted to show a helical-gear type of speed reducer

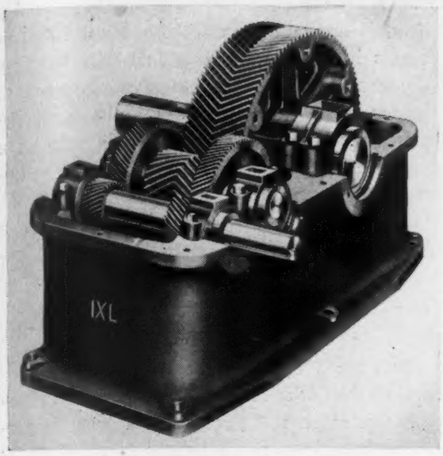
The Farrell Foundry and Machine Co., which has specialized in herringbone gears for many years, has this to say:

"Herringbone gear units are more efficient and durable than straight tooth gear units and are used on nearly all important installations where heavy powers are transmitted at comparatively high speed. While there has not been so much progress made with the smaller units, the number used is increasing very year and there are indications that eventually they will be preferred wherever they can be applied.

"It has been well-known by engineers for the last twenty years that double helical gears will transmit loads more uniformly, more smoothly and efficiently than straight tooth gears. There were certain flaws in the design of double helical gears until 1911 which were due to manufacturing difficulties. The helical angle was limited to 23 deg. and tool clearance was necessary in the center of the gear face, which detracted from the bearing surface and weakened the tooth. In 1911, these limitations were overcome by the invention of the Sykes gear generator which generates double helical continuous teeth



Three views of worm gear speed reducer with worm shaft mounted above the gear



Typical small double reducer using herringbone and helical gears

from the solid blank with 30 deg. helical angle and sharp apices.

"Close attention was paid to tooth profiles and tooth proportions; to materials for gears and methods of testing, and the results of these investigations applied to the design of Sykes gears.

"Tests held at the National Physical Laboratory of England show the efficiency of these gears to be 99.44%.

"Sixty different units using herringbone gears have been designed with the bearing housings an integral part of the case, and fitted with replaceable, ball, roller or babbitt lined bearings, which are automatically lubricated by splash and flood system from the interior of the case. They are all sealed to prevent oil leakage or the introduction of dirt into the case.

"This company at present is supplying over 85 of these light type single reduction units to the Great Lakes Portland Cement Co. for their new cement plant. A schedule following shows their application. It will be of interest to note from the schedule that by intelligent planning it is possible to use two sizes of units throughout. This reduces the initial cost enormously and the difference in ratio of each machine can be made up by changing the ratio of the chain drive which is fitted to the low speed end of the reducers. It also greatly facilitates the stocking of spare parts.

"Another unit of interest is an offset double reduction unit, which is particularly suitable for kiln drives where the motor has to be some distance away from the heat of the kiln. A large number of these units are being supplied to the Federal Portland Cement Co. for driving their cement kilns.

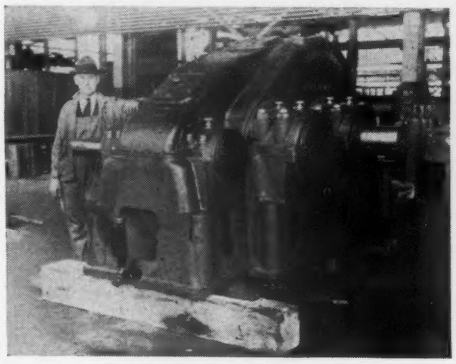
"All of the units have an efficiency of 98 to 98.9%, are oil-tight, dust-proof, and require no attention after they are installed.

HERRINGBONE SPEED REDUCERS AT NEW PLANT OF THE GREAT LAKES PORTLAND CEMENT CO.

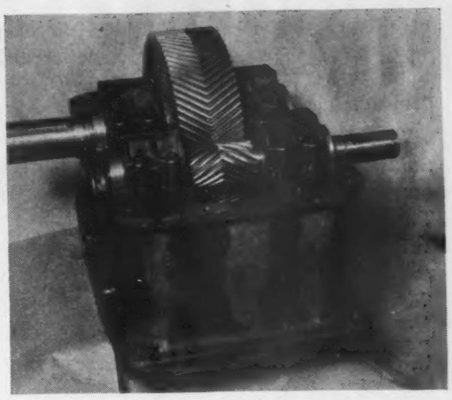
Machine	Hp.	R.p.m.	Ratio	Farrell-Sykes Drive
36-in. belt conveyor	10	750	13¾/1	SL-18
Apron feeder	5	750	13¾/1	SL-11
Rock carrier	25	750	13¾/1	SL-18
Coal elevator	20	750	13¾/1	SL-18
Slurry screw	7½	750	13¾/1	SL-11
Slurry feeder	4	900	13¾/1	SL-11
Clinker drag	10	750	13¾/1	SL-18
Clinker carrier	25	750	13¾/1	SL-18
Dust elevator	15	750	13¾/1	SL-18
Dust screw	5	750	13¾/1	SL-11
Cross dust screw	7½	750	13¾/1	SL-11
Slurry mixer	5	750	13¾/1	SL-11
Dry mill feeder	4	900	13¾/1	SL-11
Cement screw	10	750	13¾/1	SL-18
Cement screens	10	750	13¾/1	SL-18
Cement pump	100	1500	1.55/1	ST-6½/7
Coal dust screw	5	750	13¾/1	SL-11
Silo screw	25	750	13¾/1	SL-18
Cross screw	7½	750	13¾/1	SL-11
Elevator and screens	15	750	13¾/1	SL-18
Spill screw	7½	750	13¾/1	SL-11
Rev. bin screw	5	750	13¾/1	SL-11
Cement bin screw	20	750	13¾/1	SL-18
Bag wheel	25	750	13¾/1	SL-18
Sorting belt	5	750	60/1	DV-8

Complete Line of Reduction Units

At least one manufacturer now makes a complete line of all types of geared-speed reducers. This is the Philadelphia Gear Works, which lists the following:



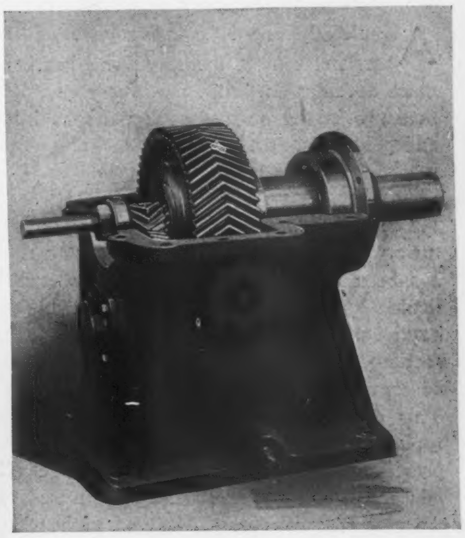
A very large horizontal herringbone type speed reducer



Single reducer with herringbone gears

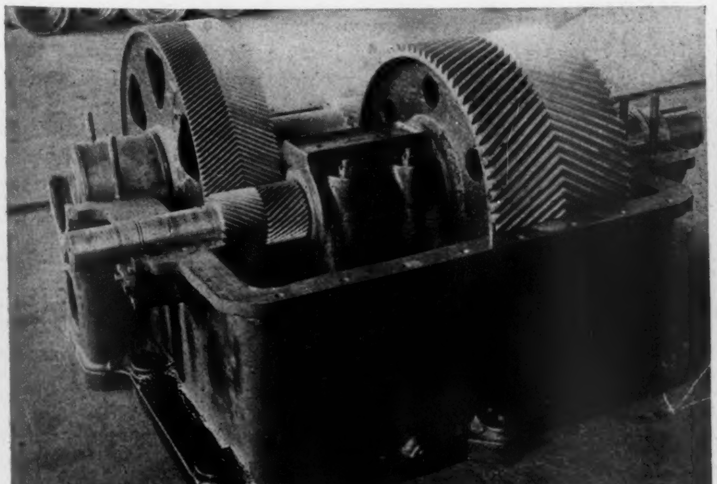
Worm, spur, herringbone and spiral bevel herringbone—all in various sizes and ratios.

The worm gear type is made in a num-

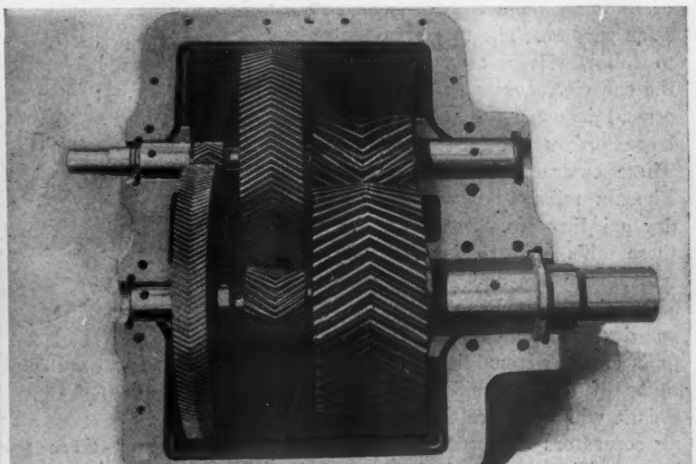


Vertical type herringbone double reducer for ratios to 130 to 1

ber of different models—right angle, vertical or straight line drive (the latter being a "double reduction unit"). They can



Double reduction horizontal type of herringbone reducer good for power up to 25 hp. and ratios up to 80 to 1

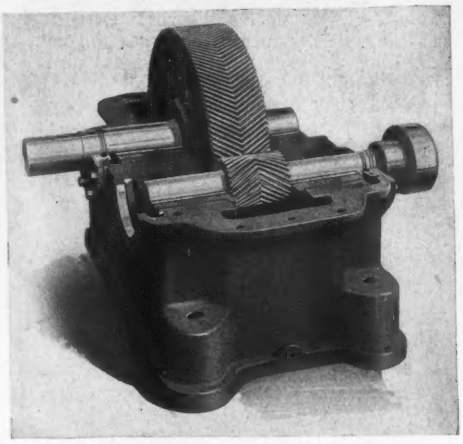


Triple reduction herringbone reducer; power up to 2.5 hp. per r.p.m. of low speed shaft and ratios to 200 to 1

also be had with the worm .below the worm gear, or above same. The herringbone units are available in single and double reduction types.

The spur gear types are made in two models, each embracing various horsepower capacities and reduction ratios. The spiral bevel-herringbone type is available in various sizes and ratios and is recommended by the manufacturers for "high speeds."

The foregoing is a fairly comprehensive discussion of geared-speed reducers—justified, we feel sure, by the extraordinary interest taken in them during the last few years in the rock products industry. Pracically all new plants in the industry are using direct-connected geared drives.



Single herringbone type good up to 20 to 1 ratios and power up to 300 hp.

Cement Mill Machinery

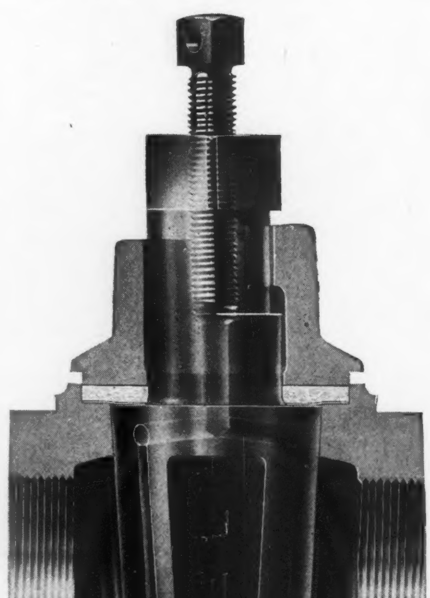
AS already noted in our review of the portland cement industry there has been much development in the machinery end, particularly in the size of such units as kilns and grinding mills.

Mills

The Traylor Engineering and Manufacturing Co. states that "its compartment mill has been improved in several respects, particularly the diaphragm and the trunnion bearings. The diaphragm screen is made in sections with the bars cast *en bloc,* instead of the separate bar forgings formerly used. This design enables the operator to make replacements very much more rapidly than previously. The trunnion bearings are oil lubricated, being of the same design used in the new rotary kilns. This type of bearing is claimed to be particularly well adapted for use on compartment mills because of the very heavy load that must be carried.

The Allis-Chalmers Manufacturing Co. states that "the trend in the cement industry, being decidedly toward finer grinding, necessitates the construction of larger diameter and longer finish grinding mills, as well as of mills with the latest refinements for the same purpose. The raw grinding mills have to follow suit in order to keep abreast of the capacity requirements. The needs of the cement industry are well illustrated by the large orders received for Compeb mills. These contracts include among others the Phoenix mills (two wet grinding and two dry grinding No. 8740 mills, the largest of these mills built so far), the Great Lakes mills (four wet and four dry grinding No. 830), the West Penn mills (two wet and one dry grinding No. 830), and the Florida mills (seven wet and dry grinding No. 8726). Some of the dry mills on these and other orders will be operated in connection with air separators in closed circuit and dust collectors. The stream of air flowing through the mill serves the double purpose of cooling the mill and removing part of the fines, thus making far better grinding efficiency.

"A great deal of the development work was necessary in connection with these large mills. Certain parts of the mill, such as the heads and shell flanges, combination division head, cone discharge, gear and pinion, etc., had to be redesigned for the greater loads and capacities incidental to the larger size, and it goes without saying that the company put to task all its past experience in redesigning these parts, making improvements



Slurry valve with grease cylinder that keeps it from binding or leaking

wherever there was an opportunity. For 8-ft. diameter mills there was developed a special plain division head with tool steel bars, which can be used for either wet or dry grinding in certain cases where neither the standard grid nor combination division head is desirable. In making these developments it was kept in mind that in due time the necessity will undoubtedly arise for still larger mills than the ones building at the moment. Thus, this company is now in a position to anticipate with confidence the immediate future of cement mill design. In fact, it has already secured contract for a No. 835 Ballpeb mill, and have quoted several customers on No. 840 mills."

Kilns and Coolers

In regard to developments in rotary kilns and coolers, the Allis-Chalmers Manufacturing Co. states: "Additions of great importance have been made to our kiln and cooler equipment. We have developed new driving and carrying mechanisms for the larger size kilns and coolers. The driving mechanisms are so designed as to give the proper reduction for direct connection to the motor, obviating the necessity of installing separate speed reducers or belt drives. The advantages of these new drives are apparent. All the gears are totally enclosed, the high speed gears having a cast-iron housing which is oil tight and dust proof. The main pinions are located at 30 deg. off the vertical center lines of the kiln or cooler, and are thus located directly under the charge. This allows the bearing reaction to be taken up entirely by the bearing base, removing strains from the bearing cap. The carrying mechanisms are equipped with a new type of oil wheels which insure automatic lubrication of the bearings, the oil being circulated out of a large reservoir in the base of the bearing. The bearings are also arranged for water cooling if this is desired."

The Traylor Engineering and Manufacturing Co. describes its new developments in rotary kilns thus: "It has always been difficult to correctly line up the supporting rollers of a rotary kiln, during the process of erection, and equally troublesome has been the problem of maintaining the alignment in operation. The reason, of course, lies in the cradle design of support, with its double rollers which are very hard to align, particularly because they cannot assume their correct position until the shell is resting upon them, when fine adjustment of the position of the bearings is rendered difficult by reason of the great superimposed weight. All of this is overcome by the simple expedient of mounting the shell upon new Traylor design single rollers, set in rigid bearings securely bolted to very substantial structural steel frames. By this construction, correct alignment is easily secured before the shell is placed in position, and adjustment during operation is equally facile.

"The lubrication of the roller bearings is by oil and is automatic, being accomplished by oil elevators or bucket wheels mounted on the roller shafts at the outer ends.

"The lower buckets of the oil elevator are submerged at all times, and the oil is carried to the top of the shaft and discharged to a

spout extending to the center of the journal, continually flooding it.

"In the oil reservoir are placed pipe coils for water circulation, to maintain a proper temperature of the lubricant, and suitable seals are provided to prevent its escape or the entry of dirt."

Large Units

"The year, for Traylor, has been featured by the large units of cement-making equipment which have been furnished, and which clearly indicate the trend of the industry toward greater capacity and finer grinding.

"All of the kilns and mills furnished during 1926 have been larger than those previously built and to two prominent cement manufacturers have been furnished the 'world's largest' of their kinds.

"One of these companies is using two Traylor kilns 11 ft. 3 in. dia. to 10 ft. 0 in. dia. by 343 ft. 9 in., built on five supports of the new single roller design. The other has purchased one kiln 11 ft. 3 in. dia. by 300 ft. on four single roll supports, together with two 8 ft. dia. by 40 ft. and one 8 ft. dia. by 30 ft. three-compartment mills.

"From inquiries now being received, the indications are that, in 1927, not only will units such as these supplant present equipment, but still larger ones will be demanded by the industry."

During the year the Manitowoc Engineering Works built and shipped what is one of the largest kilns ever built, 11 ft. 6 in. inside diameter for the entire length of the shell.

Automatic Proportioning of Mill Feeds

The first use of Schaffer poidometers in the portland cement industry seems to have been for proportioning raw materials in the dry process, and for proportioning gypsum to the finished clinker. Recently another distinctive use has been developed for proportioning the mix and water in feeding the raw grinding mills, as well as for measuring and insuring a uniform feed to dry-process mills, on both raw and finish ends. They are also being used to feed dryers in the dry process. Every mill operator knows that the efficiency of a grinding mill depends much on the regularity of the feed; in this case it is possible to accurately weigh the feed, and to change it as desired.

Slurry Handling

The Manitowoc Engineering Works brought out a new slurry agitator in 1926, described in Rock Products, November 13, 1926. It is called the Minogue agitator and was designed and patented by R. E. Minogue, assistant superintendent of the Manitowoc Portland Cement Co.

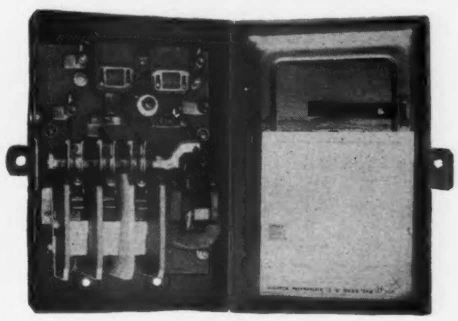
The progress of the Wilfley slurry pump in 1926 has shown its special adaptation for this purpose. Similarly a special valve, well-known to the mining industry, found its way in the portland cement industry in 1926, and has made rapid progress. This is the Merco Nordstrom plug valve, described as follows: "This valve is of the general design known as cock. The cock type of valve is the very oldest form of shut-off known to civilized man. The ruins of Pompeii have disclosed that in these cities dating back to the Roman Empire, the ordinary plug cock was in use at that time, made in bronze and wood. It proves the inherent value of the principle of the cock that it has served through all these centuries, but it is peculiar that there has been little or no improvements in the design for all of these centuries up to just a few years ago. This improvement was covered by the patented lubricating principle and embodied in the Merco Nordstrom plug valve. The valve has been on the market for approximately six years and is becoming standard practice for many industries—in the cement industry in the last year.

"This valve has proven its worth on account of the patented lubricating principle. The lubricant is used to wash the gritty material from between the bearing surfaces. The pressure in the lubricant chamber is always more than the pressure in the pipe line. This makes it impossible to have a building up between the plug and body of gritty material to score the bearing parts.

"Further, with this principle of high pressure lubrication, it is possible to seal shut a Merco valve against leakage even if the bearing surfaces have been quite badly scored. This principle further eliminates to a minimum, wear and maintenance cost. There is no pocket for the accumulation of sludge that will interfere with full shut-off. There is no restriction in the area, the water-way through the valve is equivalent to that of the pipe line."

Power and Power Equipment

IN the primary power field of the rock products industry in 1926 we find that we have posted our readers during the year on (1) a new magnetic clutch built into standard synchronous motor by the Westinghouse Electric and Manufacturing Co. (February 6 issue); (2) a new steam generating unit by the Combustion Engineering Corp., April 3; (3) the new type "L" Diesel engine, 4-cycle, entirely enclosed, 45 to 475 hp., by the Foos Gas Engine Co., June 12; (4) a general discussion of ball-bearing electric motors, July 10; (5) the new General Electric mill type compensator, October 2; (6) a new type of waste-heat boiler by the La Mont Corp., December 11. Two new flexible couplings were described, the Poole Engineering and Machine Co., January 9, and that of the Falk Corp., November 13.



Push-button starter for alternating current motors

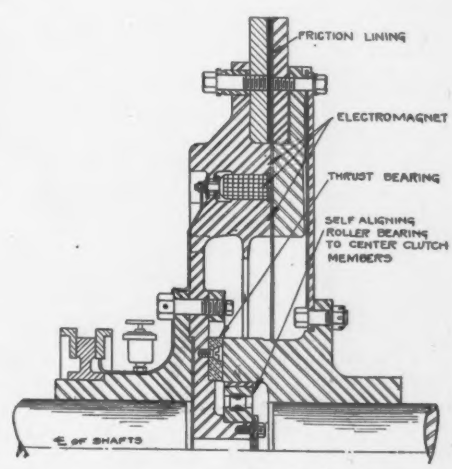
Electric Motors

In electric motors there seems to have been no outstanding developments other than the one already referred to. The Westinghouse Electric and Manufacturing Co. also announces the development of a new regulator for preliminary grinders in cement mills, etc., for varying the quantity of material entering the mill. The current of the main driving motor passes through a series transformer, whose secondary influences the material feed motor. Thus excessive mechanical loads and main motor currents stop the inflow of fresh material. This company has also developed a direct motor drive for very large rod mills, using a single reduction helical gear around the center of the mill.

The Allis-Chalmers Manufacturing Co. states that its production of roller-bearing induction motors is constantly increasing.

A new Allis-Chalmers development during 1926 is the enclosed self-ventilating motor. A number of important applications of this type of motor in cement plants, chemical plants, etc., have demonstrated its adaptability. An increasing demand for a motor of this type in many lines of industry indicates a ready market.

An order from a large stone company is for enclosed self-ventilating motors of various sizes. This installation will be a splendid example of the advantages of protection to motors against a large volume of dust and grit always present in a stone-crushing plant.



A centering bearing for magnetic clutch

Electric-Motor Accessories

During the past year the Cutler-Hammer Manufacturing Co. has perfected a push-button-operated, automatic starter for use with alternating current motors of small and average capacities which can be connected directly across the line. These starters are made in three types. Each type takes care of a wide range of motor capacities. Installations in cement mills in service such as on pumps, compressors, etc., have shown these starters to be ideal for this class of work and for general applications in cement mills.

Another improvement made by the Cutler-Hammer Manufacturing Co. is the centering bearing as applied to its line of magnetic clutches. In operation the roller bearing forces the two clutch members to engage concentrically at all times, regardless of the position of the shaft bearings. When the bearings for the shafts, on which the clutch members are carried, are out of position, due to settling of foundations, or wear, the ends of the shafts inside the clutch are swung into correct relation with each other.

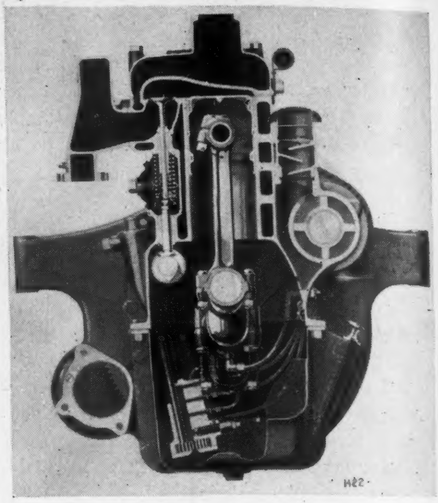
Gas and Oil Engines

One of the new Foos Gas Engine Co.'s new "L" type Diesel engines (described in Rock Products, June 12, 1926) is illustrated herewith as an example of the tendencies in oil engine design. The complete enclosure of the working parts of the engine make it especially adaptable to installations in the rock products field. It is a relatively high-speed engine (600 to 900 r.p.m.).

The Power Manufacturing Co. announces recent changes and improvements in the "Primm" oil engine. It is claimed a considerable reduction in fuel consumption has been effected by a combination of new features. The first of these is the heat compensator, which is a part of the cylinder head as shown in an accompanying illustration. The heat compensator is simply a flanged bowl made of grey iron, the wall of which encircles the inside of the cylinder head wall and is spaced a fraction of an inch from this cylinder head wall. The engine is started by means of a hot plug inserted in the top of the cylinder head or by an electric plug which has been perfected within the last year and which has proved very satisfactory.

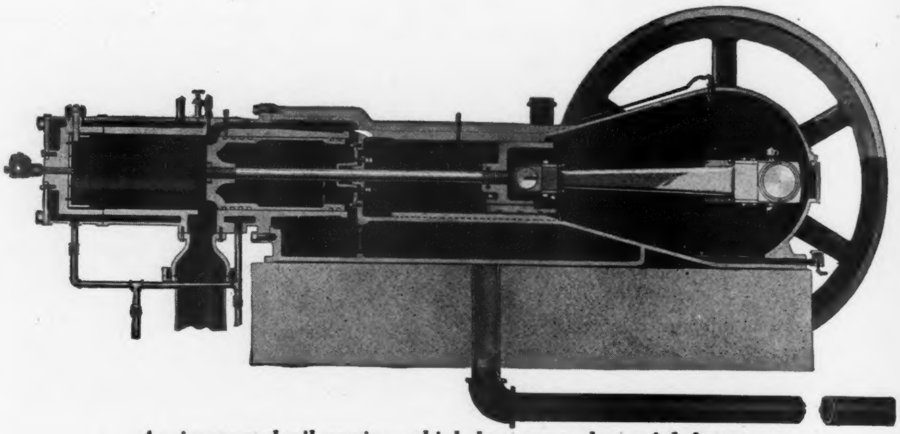
A second new feature is a special type cam-operated fuel oil injection pump which is mounted in a central control box which also contains the governor, the starting mechanism, etc. The cam-operated pump allows quicker injection of the fuel oil and, consequently, enables more of it to be burned and more of its power to be transformed into work.

Another improvement is a new type crosshead. This crosshead, as shown in the accompanying view, is of cast setel and equipped with a babbitted and removable shoe. The crosshead serves the purpose of absorbing the angular thrust of the crank and connecting rod and preventing the egg-shaped wear of the cylinder and piston.

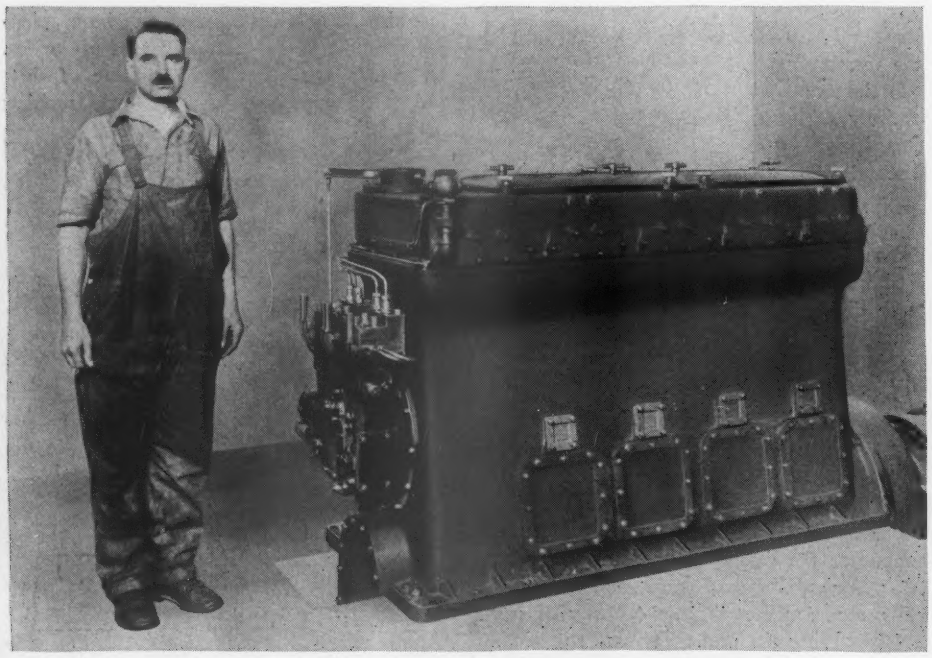


Details of improved gasoline-engine unit

The control mechanism has been centralized in one box, which, in adidtion to a governor, fuel pump and moisture injection valve, also contains the automatic air starting equipment so that it is only necessary to open a small, quick-acting gate valve in order to start the engine. The automatic air valve then controls the injection of air into the cylinder so that air is injected only when the piston is ready to start on the power stroke. Fuel oil is injected by the fuel pump at the same time as the air so that starting is practically automatic. When the engine is started, the gate valve is closed and an air compressor that is a part of the standard installation compresses air for the next starting operation.



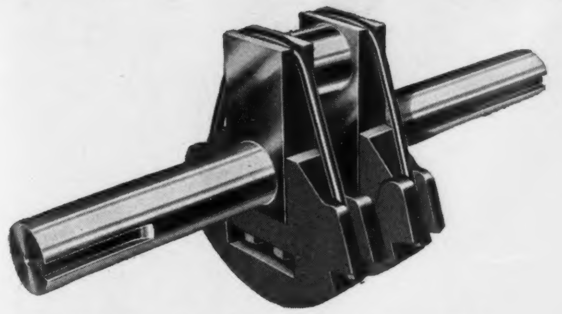
An improved oil engine which has several special features



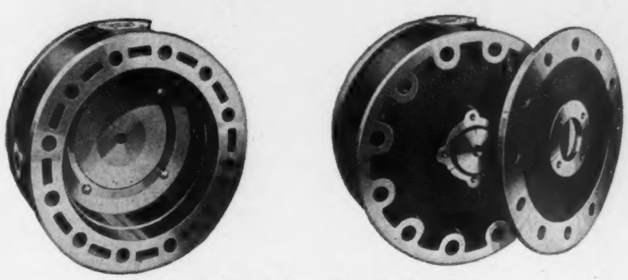
Completely enclosed small high-speed Diesel engine

Portable Power Units

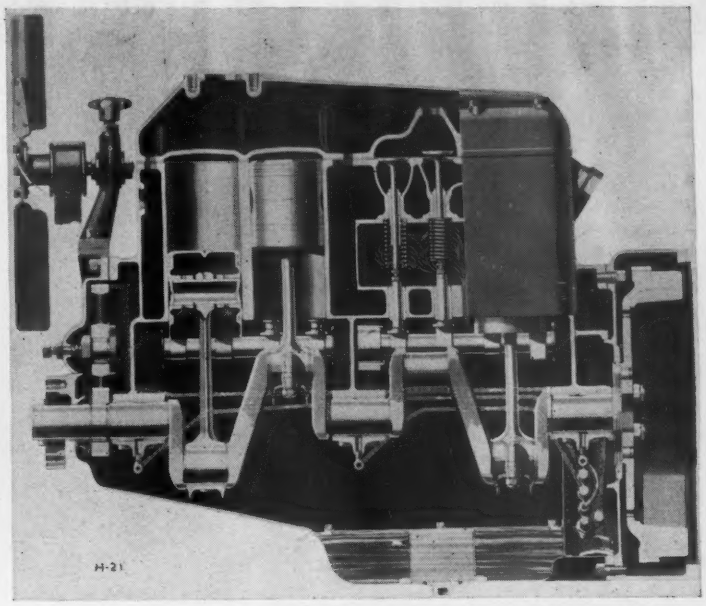
There has been notable progress in compact portable gasoline engine power units for various purposes. For example, the Cook Motor Co. has developed three such units, one for electric power generation (for plant lighting, etc.); a centrifugal pumping unit, and a force-pump unit. In the electric power unit the engine is direct-connected through a flexible coupling to a 5- or 7½-k.w. ball-bearing generator. The whole unit, which includes the engine, generator and switchboard, is mounted on a riveted chan-



Details of improvements in oil engine



Cylinder-head details of oil engine



Gasoline engine designed to be compact, simple and rigid

nel iron base. The unit can be furnished mounted on wheels if desired. The other units are similarly compact and portable.

The Hercules Motors Corp. claims the special features of its power gasoline engine units are compactness, simplicity, and rigidity. Perhaps the best evidence of the constantly greater attention being paid by motor manufacturers to the requirements for severe service in the rock products industry is the following list of special alloys and materials used in the Hercules motor:

"The exhaust valves are of silchrome steel. The cylinder casting is of chrome alloy semi-steel. The pistons are of a chrome alloy.

"The push rods are of molybdenum alloy, as are the wrist pins; both assured of a uniformity and hardness to withstand a Brenelle test of 220. This molybdenum alloy developed for uniformity and hardness is the result of experimental work of the Timken Roller Bearing Co. The connecting rod bolts and flywheel bolts are double heat-treated in the bar before machining. Cylinder head bolts are of vanadium alloy of high elastic limit to withstand any stretching tendencies that may be imposed. Connecting rods and crankshaft are of high carbon steel, double heat-treated. Main bearing caps are forged from high carbon steel, heat-treated. The bond between the babbitt and the forging has been worked out so as to form an inseparable and integral whole. Water pump and camshaft gears are of forged steel of high carbon content. The camshaft and idler gear are chrome alloy semi-steel castings, of more than double the tensile strength of the ordinary grey iron gear."

Power Drives

A full discussion of geared speed reducers appears under a separate heading.

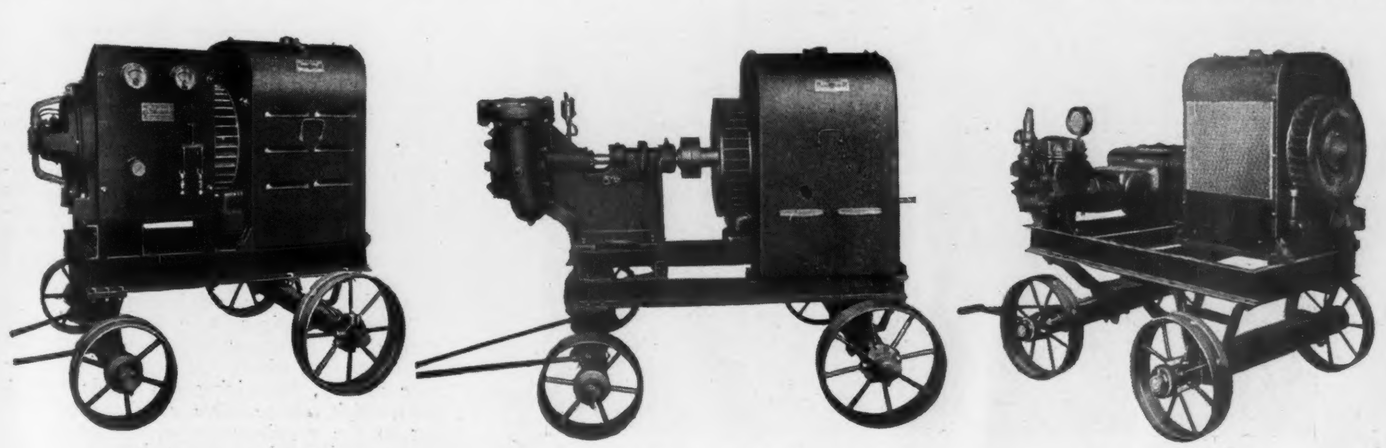
The Allis-Chalmers Manufacturing Co.'s "Texrope" drive, which was introduced something more than a year ago, according to its makers, has found a considerable number of new applications in the past year. In the rock products industries, Texrope drives have been applied to crushers, tube mills, brick machinery, fans and other driven machinery. The Texrope drive with its short centers permits better arrangement of the machinery than would be possible with belts and allows higher speed motors than for direct connection and also gives greater flexibility.

Speed reducers have not changed the status of chain drives, in fact they have increased the opportunities for chain drives in the rock products industry. The Morse Chain Co. reports it has made great progress in 1926 in the development of a chain drive especially adaptable to excavating machinery. It is now used quite extensively by such concerns as Jeffrey, Brownhoist, Browning, Byers, Erie, Osgood, McMyler Interstate, Palmer-Bee, and others. The following testimonial from H. C. Beckwith, general manager of the Byers Machine Co., sums up the advantages of chain drives for this kind of equipment:

"In our 10-ton capacity revolving cranes, a 70-hp. gasoline engine furnishes the power for driving the entire crane, including lifting, moving, and revolving. The connecting link between the gas engine and the drive has always been a Morse silent chain.

"The engine operates at 800 r.p.m. and the jackshaft at 150 r.p.m. A Morse chain 6 in. wide accomplishes the 5⅓ to 1 reduction, using 52-in. centers.

"Morse chains were chosen because of their flexibility—an especially valuable point with us, because the crane rocks and vibrates,



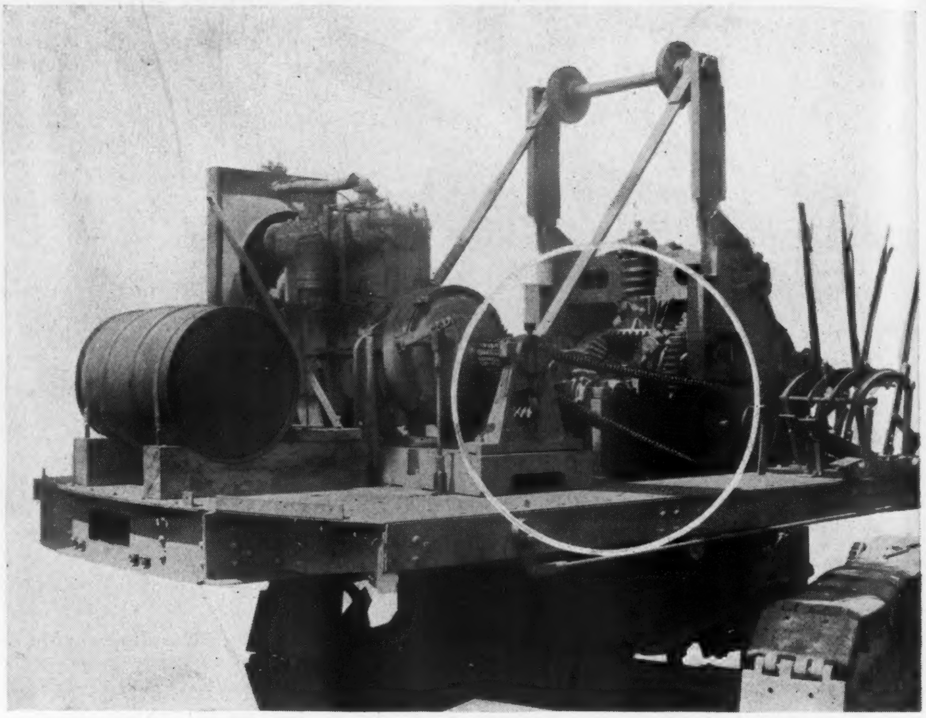
Three units, for electric light generation, for running a centrifugal pump and for running a force pump

and the frame is subjected to heavy stresses. These difficulties make the direct gear drive impractical. Belt drives were of course out of the question, especially because of the short centers necessary on an installation of this kind.

"The Morse chains are quiet, sturdy, and demand practically no maintenance. We have had almost no breakage or failure from over 200 cranes of this type in service, although the chains are subject to varying strains, constantly jumping from no load to overload. In fact, the use of the Morse chain is one of our strongest quality talking points in the sale of our Model 10 cranes."

Chain Drives Combined with Speed Reducers

As noted elsewhere, in the discussion of geared speed reducers, there are many possible combinations of chain drives and speed reducers. The new plant of the Great Lakes Portland Cement Co., at Buffalo, has a number of such drives, a list of which may be found on p. 207 of this issue. There is little doubt that there will always be a place in the rock products industries for chain drives, although belt drives seem to be going out of style except for primary breaker drives, where a stoppage is supposed to cause the belt to slip or come off.



Example of a chain drice for cranes and shovels

Advances in Lubrication

THE Tredick Oil and Grease Co. engineers state that they have made a special study of crusher lubrication, and are recommending grease as against oil lubricants. They say:

"Wherever we have substituted our 'Troco' crusher grease for oil we have been able to show an actual saving in lubricants of anywhere from 100 to 200%. Where the average crusher will use from two to three gallons of oil per day, we have successfully lubricated this crusher, with greater efficiency, and used only from two to four quarts per week of grease. At the same time, by the use of grease, we have in nearly all cases doubled the life of the eccentric, and in some cases tripled it.

"The grease being in a semi-liquid form, is used in identically the same manner as crusher oil. The operator to adopt this grease does not have to make any change in his equipment whatsoever. The grease can be used with equal efficiency in either cold or hot weather.

"Another very important feature in the use of grease is a lessened fire hazard, as the grease does not drip out as crusher oil is inclined to do. And also, owing to the infrequent changes of grease, the crusher pit is very much cleaner."

Lubrication methods now being adopted in modern rock products plants

Pressure Oiling

The Keystone Lubricating Co. notes the following developments in lubrication in the rock products industries.

"CRUSHERS—The Keystone lubricator has been used on crushers for several years with satisfactory results. Early installations were made with a manifold and individual pipes to each bearing, the lubricant being applied usually to one bearing at a time. Subsequent successes in the lubricating of roll-ing-mill machinery has proven the advantage of automatic and continuous pressure as supplied by the Keystone convertor cup (accumulator). A typical installation of this kind is on a set of Traylor 26 x 72-in. ore-crushing rolls. The equipment includes a lubricator, header, line strainer, pressure gauge, convertor cup, and a quick release regulation valve for each bearing.

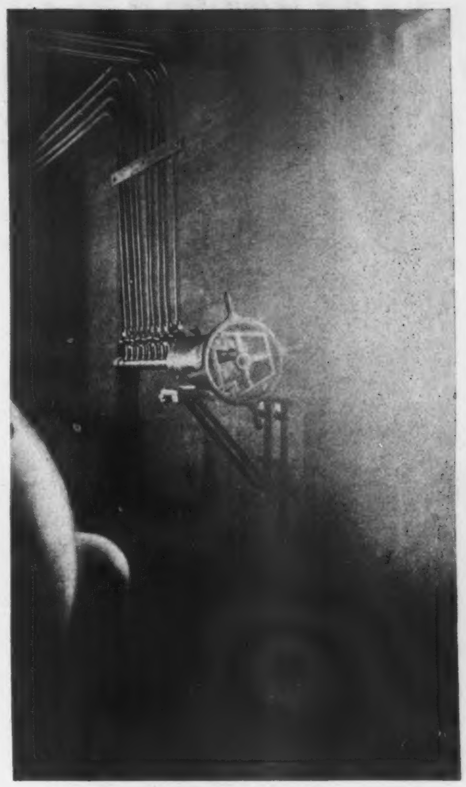
Group system of lubrication

"After the pipes have been filled with grease the lubricator is used to charge the convertor cup, which then becomes the pressure agency, energizing the whole system. Each quick release valve is adjusted according to the requirements of the bearing it serves. The quick release feature of this valve, which allows the needle to be lifted

without disturbing the permanent adjustment, was designed to provide an increase in the volume of grease flow to the bearing. This is a necessity in rolling-mill practice to take care of occasional fluctuations in pressure. While it should not often be needed in crusher lubrication, it is an added factor of safety.

"CONVEYORS— The usefulness of this system of lubrication for conveyors will be apparent from a consideration of its possibilities for group lubrication. There are installations that enable an operator to lubricate as many as 150 bearings from one central point. The positive character of this type of lubrication, as well as its time-saving advantage, recommend it for all conveyor work. The installation illustrated in the cut makes use of one No. 8 lubricator, a 1¼-in. header, ⅜-in. leads, and ⅜-in. pressure reduction valves.

"CRANES—The safety feature of this lubricator is emphasized by its use on a great many cranes, where bearings are difficult of access and at the same time frequent positive lubrication is imperative. The illustration shows a crane trolley equipped with a No. 8 lubricator, 1¼-in. header pipe, and ½-in. leads to the bearings, some of which hand lubrication might neglect."



Lubrication of motor, speed reducer and screw conveyor at a new cement packing plant

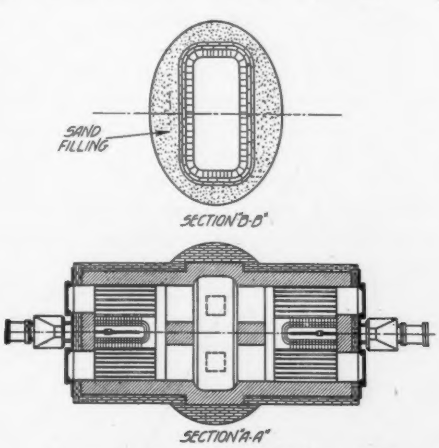
Lime Kilns and Hydrators

SOME of the most important developments in lime manufacture have been referred to elsewhere in our review of the lime industry in 1926. Among the mechanical developments mentioned was the Ward stoker, made by Arnold and Weigel, Woodville, Ohio. This stoker is illustrated and described in more detail in the following:

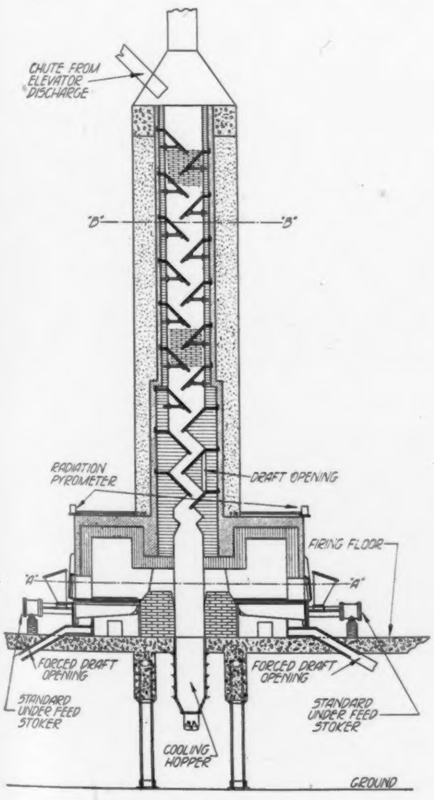
The standard Arnold kiln requires from 3 to 3½ tons of coal per day of 24 hours. To feed such a small amount of coal to two furnaces automatically and simultaneously has always been a problem for inventors and designers of automatic stokers. The Ward stoker solves the problem in a unique way, at the same time changing the character of the furnace, so that in effect it becomes more like a gas producer.

The stoker consists essentially of a hydraulically operated plunger, actuated by a small electrically-driven pump through a small pressure tank. The plunger moves the stoker cup, which is 4 in. in diameter bustion. The principle of the stoker is simside of a sleeve. On the upward stroke the cup fills with coal, on the downward the coal is discharged through a bell-shaped quadrant conical gate, which spreads it in four equal divisions over the top of the fire bed. The cup seals the sleeve over the inlet valve in all positions of the cup.

The cup under normal standard kiln operation makes about two discharges per minute of about 2.4 lb. per stroke. However, the speed of the plunger may be slowed to one discharge per minute or increased to 12 by simply adjusting the valve on the water line which controls the flow of water in the system. This stoker therefore has what is rare in mechanical stokers generally and that is great flexibility. Also the flow of coal may be retarded so that only about ½ lb. enters the cup, although 1 lb. is a normal charge.



Cross-section of baffled lime kiln



A baffled kiln for calcining small sizes of limestone

Two full size Ward stokers are used to fire the ⅓-standard-size experimental kiln at the Arnold and Weigel lime plant, which illustrates this flexibility.

As already noted, the furnace is of the gas-producer type, and has no grates. Steam and air are injected directly into the fuel bed. Ashes are removed at intervals by shoveling them out from under the bed of live coals, which bridges over.

The stoker is fed from an overhead hopper which is replenished by screw conveyors, or any standard method.

The water pressure required to operate the stokers is in a closed circuit system. The water is circulated by a centrifugal pump, drawing from a reserve tank, at a velocity of 7½ gal. per min., the return water leading back to the reserve tank. In future installations it is hoped that a non-freezing liquid can be used. As yet no difficulties have been experienced with water.

The water automatically operates a valve and piston which raises and lowers a feed cylinder on the stoker. Coal varying in size from 1½ in. to ⅜ in. diameter is placed into a hopper leading to the feed cylinder. It then feeds ahead of this cylinder, which forces it to a spreader. The spreader distributes the coal over the fire pot for combustion. The principle of the stoker is simple and economical.

The manufacturers claim that installation of these stokers in the plants of John Herzog and Son, at Forest, Ohio, the Kelley Island Lime and Transport Co., at Clay Center, and the Limestone Products Co. at Menominee, Mich., have shown an increased tonnage of lime, higher fuel ratio and an improvement in the quality of the lime, and that these results are directly dependent upon the fact, that the stone is being heated higher up in the kiln, that the fire is never dead, and that the fire doors are never opened, except at the drawing period; a 12-kiln plant equipped with these stokers has proven to be equivalent to an 18-kiln plant of hand-fired kilns.

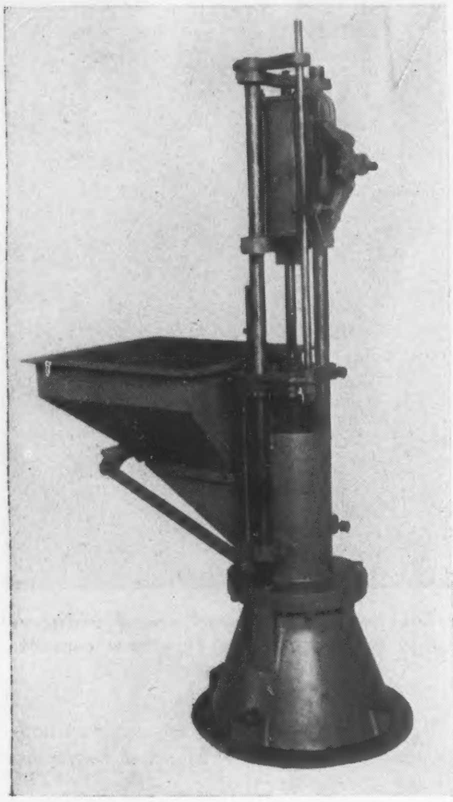
New Kiln

H. Miscampbell has designed a new style of shaft kiln which he hopes will solve the problem of burning small stone from ¼-in. to 1-in. in size. This kiln is illustrated in cross-section herewith. The cross-section of this kiln is not round, nor elliptical, but oblong, and, in the calcining zone, only 2 ft. wide. This narrow spacing between the eyes of the kiln is to insure that the heat from both sides may completely penetrate the curtain of stone slowly passing down through the kiln. The length inside has been taken at 6 ft. At suitable intervals, starting 4 ft. above the arches from the fireboxes, are a number of iron baffles, backed up with fire-brick for a ways above the heating zone and all calorized to withstand the intense heat of calcination. These baffles are to retard the flow of the stone through the kiln and, by means of suitable deflecting ribs cast in their upper surfaces, keep the burden evenly distributed throughout the length of the kiln.

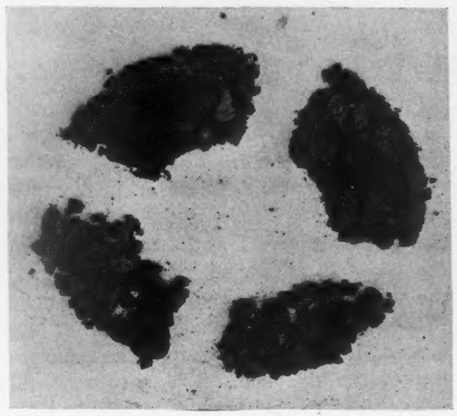
This kiln is further described by its inventor as follows:

"The cooling cone retains the shape of the inside of the kiln above, in order to avoid packing as would be the case if the standard shape cone were used. An automatic feeder or drawing mechanism at the bottom of the cone keeps a very slow but steady stream of calcined, cooled lime coming away from the kiln.

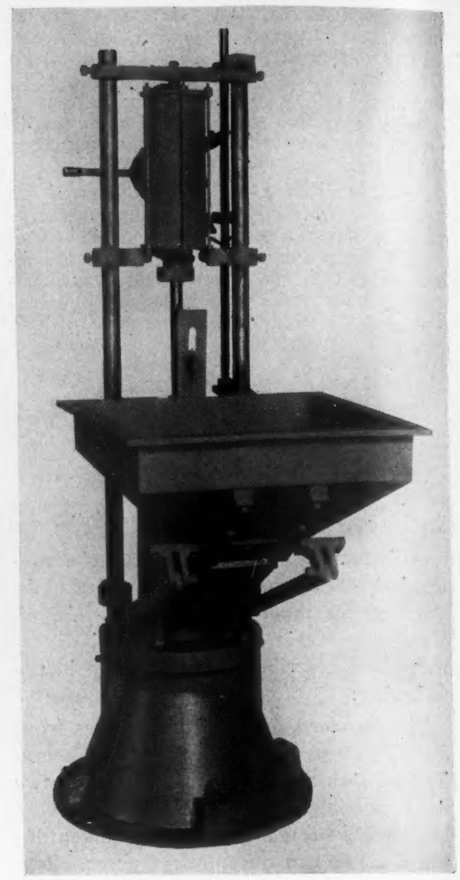
"The inventor's claim for this design is that, by it an evenly spread out film of small stone is brought for a comparatively short time through a closely regulated calcining zone and thus the use of spalls and all the fine stone above ¼ in. size is not only feasi-



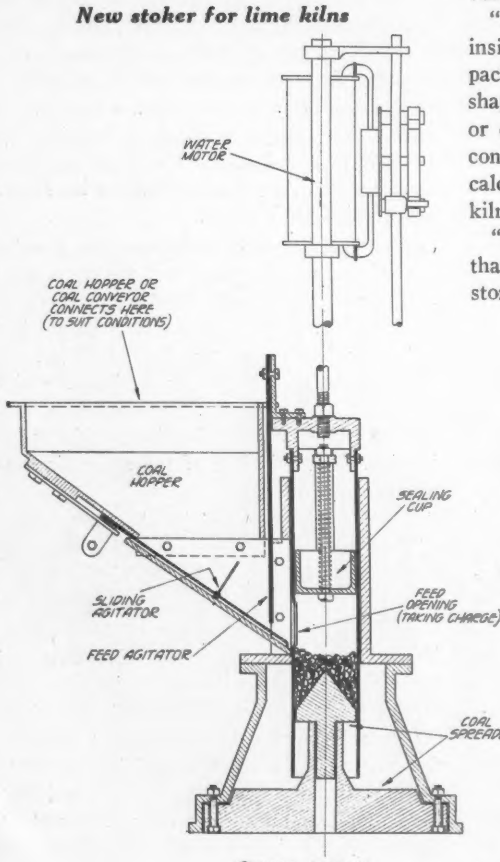
New stoker for lime kilns

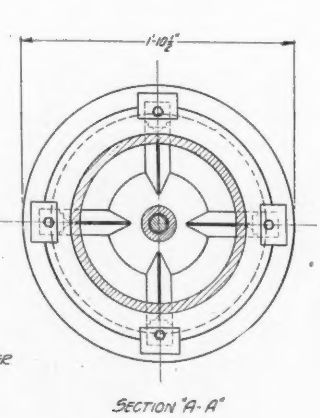


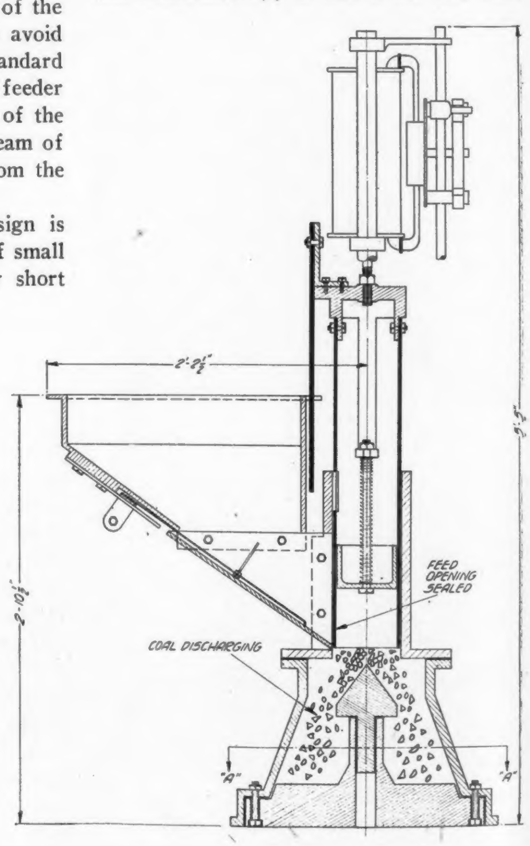
How the coal drops from new stoker



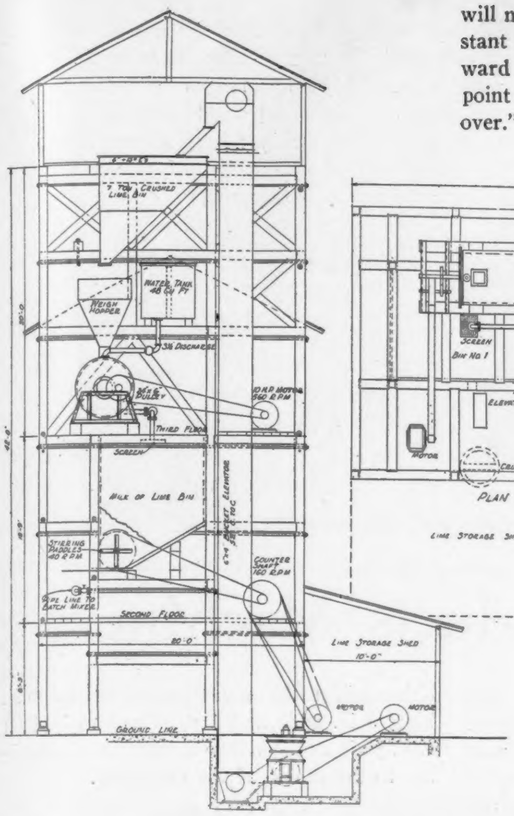
New stoker for lime kilns



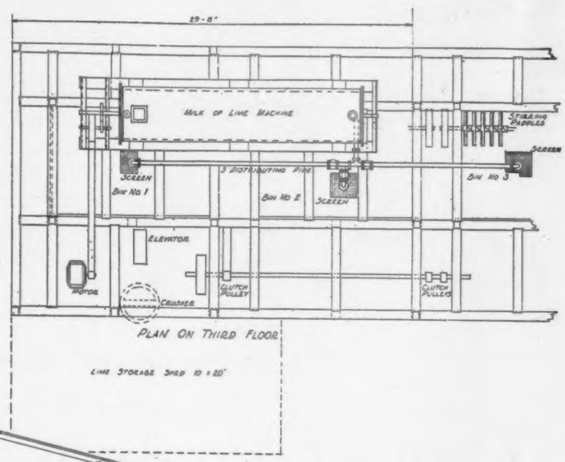




Details of a new stoker for lime-kiln furnaces which converts any furnace to a semi-gas producer



will not occur, for, though slow, there is constant motion in the stone as it passes downward and it will not stay long enough at the point of most intense heat to become glazed over."



Plan and elevation of new lime putty plant

ble but advantageous. Also a much greater ratio of lime produced to fuel consumed and a capacity from two to four times the ordinary upright kiln will be had, depending on the stone used.

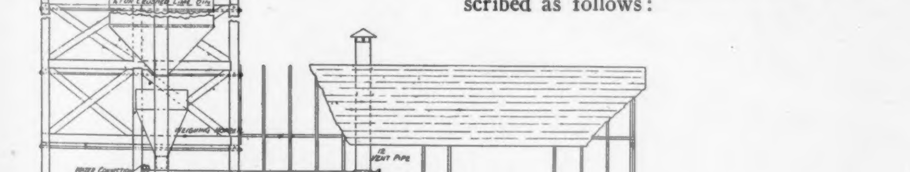
"Finally, the linings of fireboxes and kiln will last longer than in ordinary practice because it is not necessary to maintain so high a temperature in this kiln. The finely and evenly divided condition of the burden will allow the calcination to take place at nearly the correct theoretical temperature, which is several hundred degrees lower than that generally used. Overburning of the small pieces

So far as we know this kiln has not been tried out.

Hydrators

During the year we described two new lime hydrators; the new Schaffer continuous hydrator in our August 21 issue, and the new Jamieson automatic batch hydrator in our October 30 issue. H. Miscampbell also made improvements to his batch hydrator in the way of a dust washer, or collector, which was described in the December 11 issue.

The McGann Manufacturing Co., which introduced the Swiss Schulthess continuous hydrator in this country about two years ago, states that it has been much improved. The operation of this improved hydrator is described as follows:



Elevations of new lime putty and mixed mortar plant

"The lime is taken just as it comes from the kilns and is fed into the hopper of the hydrator; from the hopper, the lime passes into the revolving screen, or breakdown compartment of the hydrator; here, by an addition of water to the lime, the actual breakdown of the lime occurs and all of the lime ¼ in. and smaller in size is conveyed by the ribbon conveyor, which surrounds and is attached to the screen, to the treatment zone of the hydrator. In this treatment zone, the accumulated steam, which is generated in the screen section when lime and water meet, acts as the water supply for the broken down lime which has already left the screen.

"It is a known fact that steam or pressure is exerted in the line of least resistance; this is the case in the Schulthess hydrator. When the lime meets the water, pressure results. A small quantity of this pressure rushes to the condenser and stack outlet; here the uprush of steam is met by a baffle which turns back any particles of lime which may have been lifted by the explosion. If, however, the lime-laden steam still continues to find a way of outlet, it is met by sprays of water at different heights in the condenser column. When this lime meets the sprays of water, it drops as heated milk of lime to the bottom of the condenser, and this milk of lime is fed by a pipe into the revolving screen section of the hydrator to furnish heated water for breakdown, instead of cold water.

"The balance of the steam which is generated in slacking in the breakdown, or screen section, rushes into the treatment zone of the hydrator. When the broken down lime is conveyed by the ribbon conveyor into the treatment zone, this lime satisfies itself by reason of the temperature differences, with the condensed steam which has generated in slaking and which now is confined in the treatment zone, receiving full satisfaction for its water content, and, at the same time, under as near a vacuum as is possible."

Putty Plant

H. Miscampbell has also placed on the market in 1926 a new putty and mixed-mortar plant, the essentials of which are illustrated herewith, and is described as follows:

"The equipment provides, first, for the fine crushing of the lump lime. The crushed product is then elevated to a storage bin above the mixer. From the bin it is delivered to a standard weighing hopper, the same as used with the Clyde hydrator. Here a predetermined amount of lime is weighed and placed in the mixer. Next, the water found necessary is added, exactly, from a Clyde standard graduated tank.

"The mixer is a closed cylinder, 3 or 4 ft. in diameter and of a length sufficient to provide the desired capacity. Through the center of this cylinder and extending outside of both ends, is a heavy shaft, suitably supported by bearings. Mounted on the shaft, attached to the cast hubs, are a number of specially designed paddles. The shaft is re-

volved at the necessary speed through a train of gears and pulley from the source of power. The paddles thoroughly mix the lime and water and, by keeping it in motion, prevent burning during the process of slaking. The agitation also prevents too rapid thickening of the putty or milk of lime, as the case may be.

"While the slaking lime is still in the mixer, the additional amounts of water are added that trials have proven necessary for the desired product and at the right times. At the proper moment, a gate valve in a pipe line at the discharge end of the mixer is opened and the putty is drawn out and elevated by means of a centrifugal pump to suitable soaking bins, or vat.

"In pumping the putty into these vats, valves from the pipeline over the vats, are placed for each vat and the putty discharges onto rather fine-meshed screens. The core and also slow-slaking lime will be mostly retained on the screen. Ample surface is allowed so the screens will not plug too rapidly. Also, they are easily removable for cleaning out after filling a vat.

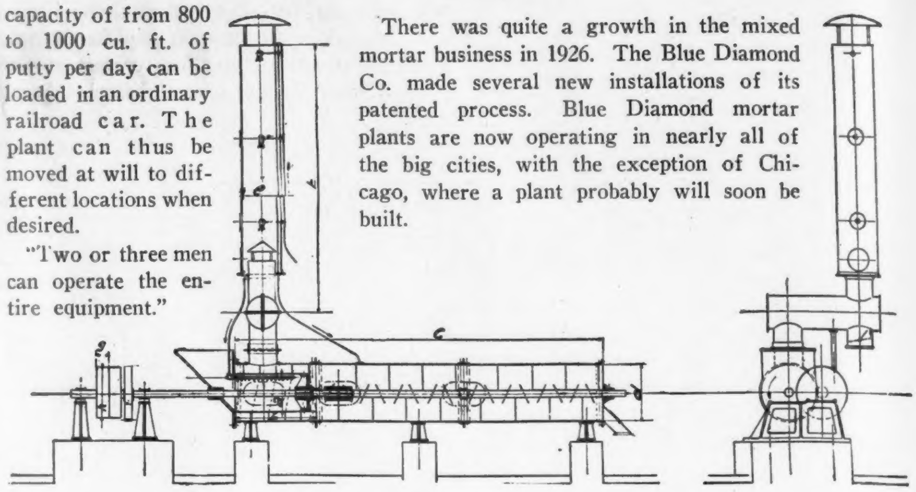
"The putty is run into a measuring hopper. Here also, are provided sand elevator, sand storage bin, and weighing and measuring hopper and a hair picker and proportioner. The sand, hair and putty are then dumped, together, into a batch mixer for mortar, in correct proportions, and thoroughly mixed.

"The mortar is then dumped into a mortar bin and from there fed, as required, into an elevator for delivery into trucks for hauling to the job.

"All the material and equipment for a complete erection of a putty plant having a capacity of from 800 to 1000 cu. ft. of putty per day can be loaded in an ordinary railroad car. The plant can thus be moved at will to different locations when desired.

"Two or three men can operate the entire equipment."

There was quite a growth in the mixed mortar business in 1926. The Blue Diamond Co. made several new installations of its patented process. Blue Diamond mortar plants are now operating in nearly all of the big cities, with the exception of Chicago, where a plant probably will soon be built.



A continuous lime hydrator with special features

Cement Products Machinery

THE Ideal Concrete Machinery Co. announces a new three-core face-down block machine. This new block maker keeps pace with the demand for an efficient machine of great flexibility, low price, and convenient, economical operation. This new machine with three-core face-down allows from 33⅓ to 40% air space and can be used either in hand or power equipment. It is supplied also for use with either wood or iron pallets.

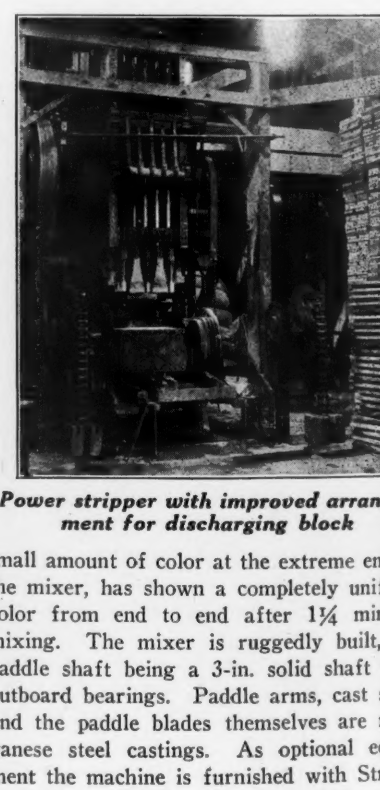
As with the other machines of this make, attention has been paid to keeping the design simple and having all parts easily accessible for repair and inspection.

When desired for use with power, the machine will make any standard blocks 8 in. high, 8 in. wide and 4, 8, 12 and 16 in. long with plain and standard or open ends, according to the desire of the purchaser.

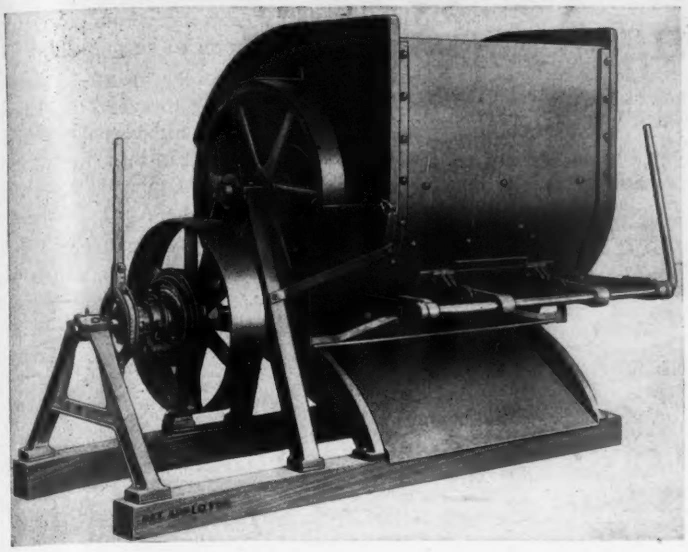
A New Mixer

The Ideal Concrete Machinery Co. has also added to its line this year an 18-ft. mixer, which brings its mixer line up to three sizes—9 ft., 14 ft. and 18 ft. The new 18-ft. mixer is built oversize, and will hold and mix 21 cu. ft. loose material. The machine is claimed to be rapid in its mixing action, and on a color test when placing a small amount of color at the extreme end of the mixer, has shown a completely uniform color from end to end after 1¼ minutes mixing. The mixer is ruggedly built, the paddle shaft being a 3-in. solid shaft with outboard bearings. Paddle arms, cast steel, and the paddle blades themselves are manganese steel castings. As optional equipment the machine is furnished with Strenes metal liners, which carry a 2-year guarantee against wear. The mixer is particularly adapted to the products plant, turning out a

A recently built cement products plant



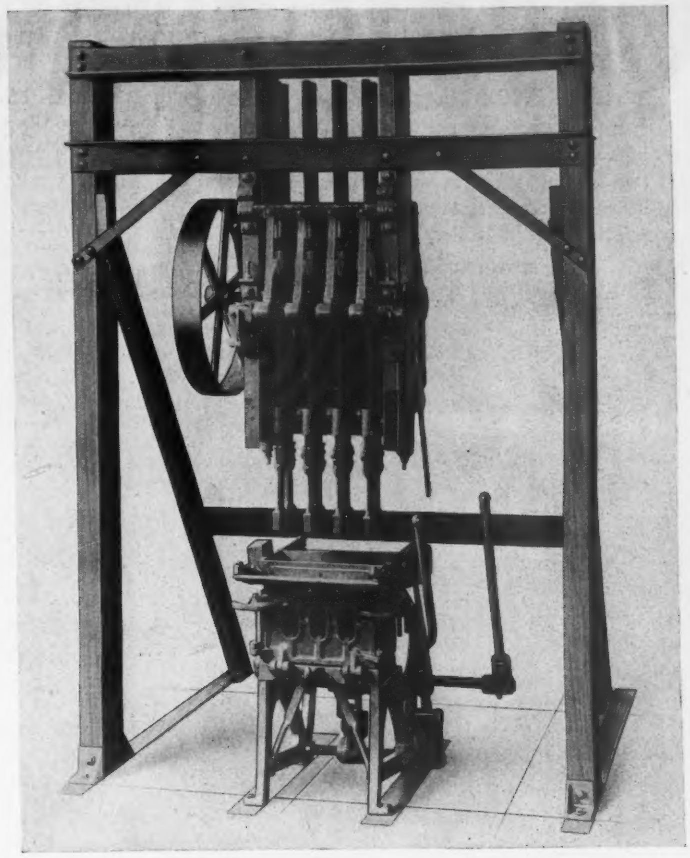
Power stripper with improved arrangement for discharging block



An addition to mixers for cement products plants

large number of units and requiring constant non-interrupted service on the part of the mixer.

The new Heskett brick and block machine, first placed on the market in 1926, was described in ROCK PRODUCTS, July 10.



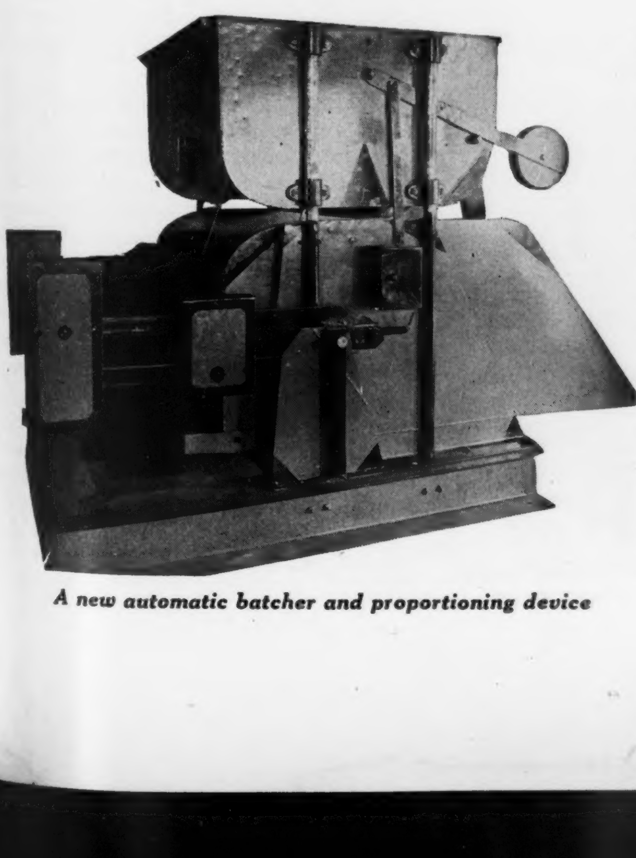
A new face-down three-core block machine

Bins and Batchers

AUTOMATIC measuring devices increased in use during 1926 and two were described in the New Machinery section of ROCK PROODUCTS. One of these was the Schaffer poidometer which has been improved by adding rolled steel flights (Sept. 18) and the other, the Heltzel single control all-steel batcher (May 15).

The Blaw-Knox Co., which was one of the first to appreciate the need of automatic measuring devices for concrete materials, has added a new adjustment to its measuring batchers enabling the volume of aggregate to be varied almost instantly. This company will exhibit its well-known inundator in a small size at the coming Road Show, a size small enough to be used by the contractor who builds house foundations and does similar work. This company has also developed a calcium chloride measurer for mounting on concrete mixers so that exactly the right amount of calcium chloride solution may be introduced into each batch of concrete.

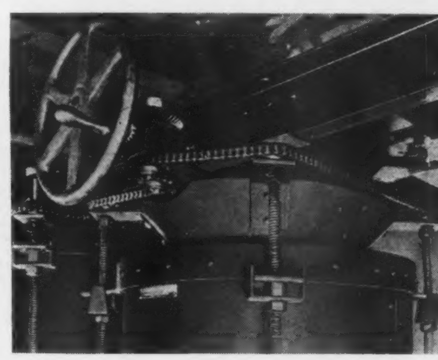
A complete line of self-cleaning storage bins which have no obstructions to check the flow of the material to the measuring device (if one is used) is one of the new improvements put out by the Blaw-Knox Co.



A new automatic batcher and proportioning device

The Heltzel Steel Form and Iron Co. has added an important improvement to its agrabatcher, an adjustment device that will permit of far greater accuracy than that of some older forms, which may be adjusted by a single control wheel. A scale is provided on which the volume to be delivered is shown. This is 8 to 14 cu. ft. in the case of the sand agrabatcher and 13 to 35 cu. ft. on the coarse aggregate agrabatcher. The wheel and scale are conveniently located so that the operator may see them as the truck is loaded.

The Markham batcher is a new automatic weighing device got up especially to load cars and trucks at sand and gravel plants. It has a receiving hopper over a dumping chute. The latter receives a load from the receiving hopper and when it contains the right amount it dumps to the car, shutting off the flow from the receiving hopper by passing a latch. After dumping the chute returns to its filling position by gravity, opening the receiving hopper for another filling and the cycle proceeds so long as sand is supplied to the receiving hopper. A counter on the dumping chute keeps track of the number of times it dumps and in this way gives the weight that is loaded into the car or truck. This weight may easily be converted to volume by the use of a factor. The machine was invented by John Markman, Forreston, Ill.



A concrete aggregate batcher adjustment device for greater accuracy

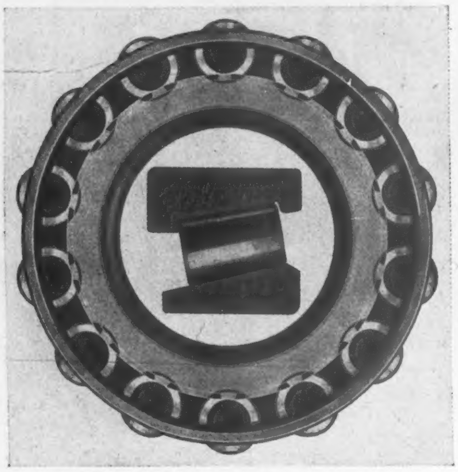
Anti-Friction Bearings

REFERENCE has already been made to the growing use of frictionless bearings in the rock products industries. The two leading manufacturers of such bearings have furnished summaries for this review.

The Timken Roller Bearing Co. states:

"Conveying equipment used widely in handling sand, gravel, crushed stone and similar materials is being built by leading manufacturers around Timken bearings.

"The Timken tube assembly with bearing cups pressed into the tube has been found



Roller-bearing device for mounting belt conveyor units

to be an economical method of mounting these bearings in conveyor units. The tubing is manufactured in the Timken steel mills and can be supplied in two sizes, 2¼-in. and 3-in. A wide variety of standard lengths may be had to accommodate the various lengths of conveyor rollers. The tube assembly may be used also as a gravity conveyor by inserting a shaft through the bore of the bearing to hold the assembly in the supports. Pressed steel closures retain a supply of lubricant for long periods without renewal. Any standard lubricating fixture may be used.

"During the past year a number of manufacturers have announced machines in which Timken bearings are used extensively. These include pavers, graders, loaders, power shovels, rollers, concrete mixers, screens and concrete finishing machines."

The Hyatt Roller Bearing Co. states:

"Development of a complete line of anti-friction pillow blocks was successfully carried on during the year.

"Standard rigid and self-aligning blocks equipped with roller bearings have been widely used in conveyors, elevators, and other types of machinery. Successful operation of this equipment over a period of years created a market for similar blocks suitable for replacement applications.

"Operators demanded anti-friction bearings that were easy and economical to apply. They did not care to go to the expense of removing shafts for heat treating, or turning down. They wanted roller bearing advantages on existing ordinary commercial cold-rolled shafts. Hyatt adapter blocks meet those requirements in a wide range of industries and applications.

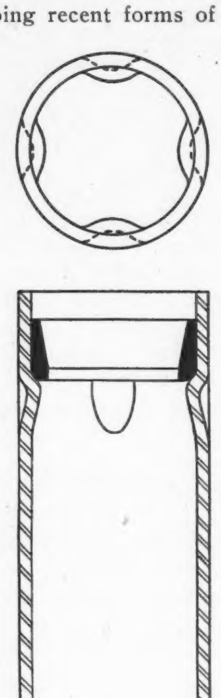
"High duty roller bearings are used, so that the rolling elements operate between both hardened and ground solid inner and outer races. The inner race is wider than the roller assembly, and is notched at each end to receive lugs which project from the retaining and thrust collars located at either side. The retaining collar is set screwed to the shaft to hold the race in position.

"As the inner race fits over the shaft, and thus provides a perfect operating surface for the high-duty anti-friction bearing element, the chief obstacle which has heretofore blocked anti-friction bearing applications to commercial cold-rolled shafts is effectively overcome.

"Adapter blocks are made with both rigid and self-aligning B. & S. housings, and while a majority are furnished with split two-piece housings, they may also be obtained with solid one-piece blocks in shaft sizes from 1 5/16-in. to 5 7/16-in. shaft diameters."

Air Separators and Dust Collectors

AIR separators will only be briefly mentioned in this review as a special article describing recent forms of these machines and covering the whole subject of air separation is soon to be published.



Details of pressed steel roller-bearing closure for belt-conveyor units

One entirely new form of air separator was introduced during the year, the Hardinge reverse current air classifier. This was described in detail in an article, "Ball Mill Grinding of Raw Gypsum," by H. G. Brown, published in the April 3 issue.

The Rubert M. Gay Co. put out a 5-ft. size of its Gayco air separator which has a surprisingly large capacity for so small a unit. On ordinary mineral products the capacity is 2½ tons per hour, 75% through 200-mesh to ¼-ton per hour, 99½% through 325-mesh.

An unusual installation of a Gayco separator solved a problem in preparing abrasives for the market. It had previously been impossible to remove the microscopic films from the water-separated material by which the abrasive quality of the material was reduced. By air separating the water-separated product in a Gayco machine, a granular product and an impalpable powder, finer than any made before in a commercial way, were produced.

Dust Collectors

The W. W. Sly Manufacturing Co. introduced an important improvement in dust collecting apparatus by bringing out a continuous dust collector. This is of especial importance to the cement industry in which grinding mills and other dust-making machines are run for 24 hours a day. The principle is very simple. The machine consists of a dust arrester in two sections and a distributing section provided with an arrangement of valves so that the current of dust-laden air may be changed from one section to the other. This permits the screens in one section to be cleaned while the other section is arresting dust so that the machine never needs to be shut down for cleaning.

An important new device introduced by the Sly company is a cement-cooling system so that hot cement may be passed from the grinding mills to the packing plant and packed without injury to sacks or machinery.

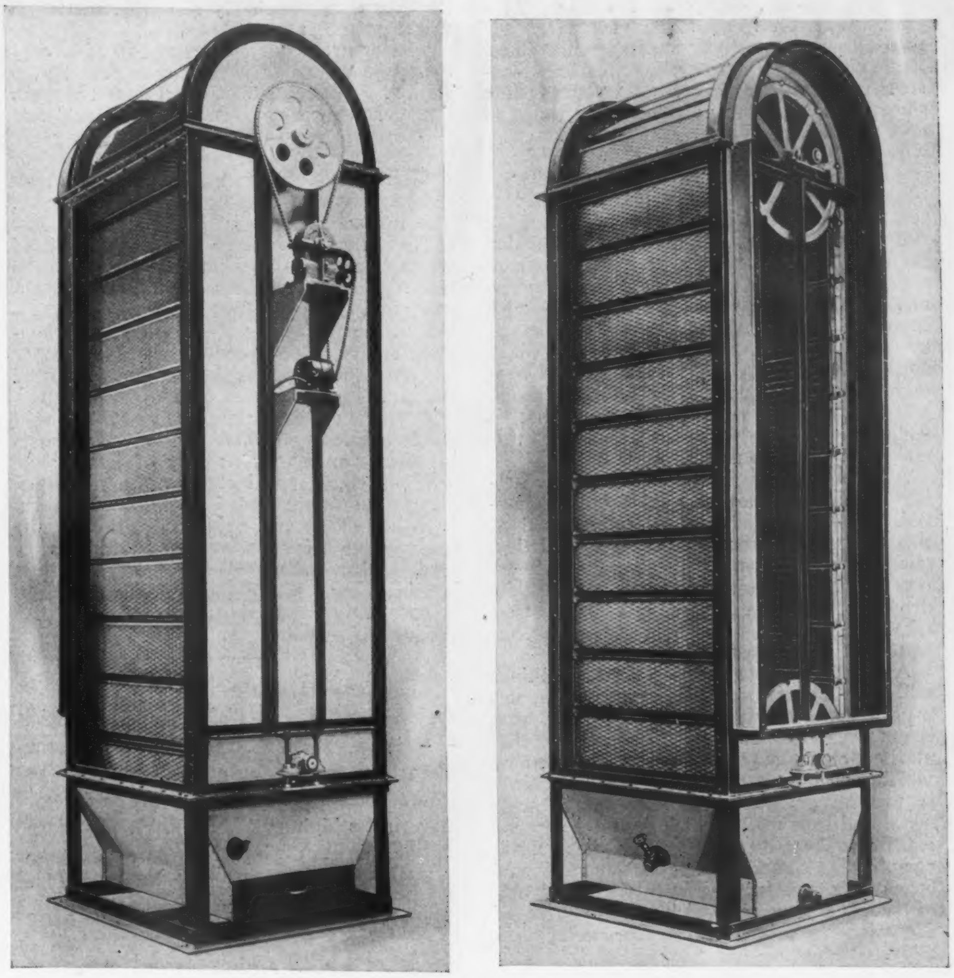
The principle of application is that a large volume of air at atmospheric temperature is passed through the cement as it discharges from the grinding units. This air in passing through the cement carries along a certain portion of this cement into a classifier-dust arrester where it gets the full benefit of the cooling air, and is immediately discharged again into the remaining stream of cement flowing from the grinding units to the storage bins or direct to the packers.

The J. W. Paxson Co. reported that while important installations of their machine had been made in 1926, no special features had been added during the year. This dust collector was described in detail in the Annual Review number for 1925.

Air Filters

A NEW type of air filter for air compressors, gas and oil engines, etc., has recently been placed on the market by the Midwest Air Filters, Inc. One of the units of this filter is illustrated herewith. This filter differs from those described in detail in Rock Products, May 15, 1926, in that it is self-cleaning.

This filter is made in standard units with air capacities from 10,000 to 25,000 cu. ft. per min., with 10-in. by 40-in. by 2-in. cells, each of 1,000 cu. ft. per min. capacity. The operation is continuous or intermittent. The power required is 1,095 k.w. hrs. per annum for continuous operation and 2 k.w. hrs. per annum for intermittent operation.



Two views of a new self-cleaning air filter

Power Show Sets New Records

IT is estimated that more than 100,000 engineers, scientists and industrial executives attended the recent Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York, N. Y. Were a definite compilation available, it would probably be found that the renewal just ended established an entirely new set of records from the standpoints of the number of exhibits, size and diversity, attendance and the volume of business transacted.

"By exhibitors and the public alike, the fifth power exposition was acclaimed a huge success, was the summing up made by I. E. Moultrop, chairman of the advisory board of the exposition. "It attracted visitors of the most notable calibre from all parts of the world, and for an entire week made New York the scientific and engineering centre of the universe.

"It is impossible at this time to even estimate the amount of business transacted at the Power Exposition, but there is hardly any doubt that it will run into millions of dollars. From the leaders in every type of machinery production to the small specialists in dozens of diverse lines we hear the same report—that they are entirely pleased with the results which have so far been received.

"Already we are looking forward to the next Power Exposition, to be held a year hence. A surprising percentage of the exhibitors has asked to reserve spaces for the next presentation, and many of them have requested that they be considered for larger space if there is any available."

Welding and Cutting Equipment

MUCH wider application is being made in both electric and oxy-acetylene welding in the rock products industries. Various examples of this have been given in onr columns during the year. Probably the most important advances have been made in welding manganese steel. A recent issue of *Oxy-Acetylene Tips* describes the successful method of accomplishing this as follows:

Manganese steel contains about 12 to 16% of the metal manganese and from 1 to 1½% carbon. There are other minor metallic constituents also, in about the same proportions as in ordinary carbon steel, but these are relatively unimportant in their effect on the properties of the metal and do not affect welding in any way.

Manganese steel as originally cast must be heat-treated to develop its desirable properties. This heat treatment consists of raising the metal to a correct temperaure, maintaining this for a sufficient period of time, and then quenching it in water. When properly heat-treated, manganese steel is so hard that, while it can be dented slightly with a peen hammer, it cannot be cut or machined except by grinding.

The fact that some of the desired properties of this metal are the result of heat treatment makes the welding problem a difficult one. Added to this is the fact that the high temperatures involved in welding also tend to change the chemical and physical nature of the metal slightly. While a second heat treatment will restore the original properties in the main casting, it is sometimes difficult to correct structural changes in the narrow zone at the juncture of the weld metal and base metal.

Manganese Steel Welding Table

Thickness of Steel, In.	Oxweld Type W-1		Prest-O-Weld Type W-101		
	Welding Head	Oxygen Pressure Lb. Per Sq. In.	Tip Size	Oxygen Pressure Lb. Per Sq. In.	Acetylene Pressure Lb. Per Sq. In.
3/16	6	14	7	2	2
¼	7	16	8	3	3
⅜	8	19	9	3	3
½	10	21	10	4	4
¾	12	25	11	6	6
1 and over	15	30	12	10	10

While it is considered that the welding of manganese steel is not yet fully developed, and while experimental work is still being done on this metal, certain practices have given satisfactory results. It is obvious that smaller castings will respond more satisfactorily to welding and subsequent heat treatment under ordinary shop conditions than larger and bulkier castings, because it is easier to heat uniformly and quench rapidly the smaller castings than those of greater bulk.

To prepare a casting for welding, the edges should be beveled to a 90-deg. total vee. This work can be done only by grinding or by cutting with the oxy-acetylene blowpipe. If the latter method is used, it is recommended that the edges be ground or pickled to remove adhering oxide.

Welding should be preceded by preheating, handled in about the same way as ordinary cast iron. Larger castings should be heated slowly in a charcoal fired preheating furnace made of bricks, while for small castings a kerosene preheating burner or even the welding blowpipe can be used. Manganese steel is quite brittle when red hot, so castings should be carefully supported during preheating and welding. Castings should be welded in the preheating furnace and protected from drafts or sudden chilling while hot.

Special manganese steel welding rods should be used. These are procurable from

the larger manufacturers of welding supplies. The blowpipe flame should be adjusted to show a slight excess of acetylene. Some very satisfactory work has been carried on with an excess acetylene flame showing an excess cone about three times as long as the inner cone.

It is essential that a comparatively large tip or welding head be used and that a large pool of melted metal be maintained at all times. The welding rod must not be rubbed in the weld but most be held under the surface of the molten pool and the flame applied to melt the rod in the pool of molten metal. When the level of the pool is high enough, it can be melted into the base metal by directing the flame around the edges until the weld metal and the base metal flow together through their own fluidity. Avoid, however, getting such a big pool that it spills over on solid metal, because this makes an "adhesion" with no bond.

After welding is completed, the entire casting should be reheated to a bright yellow-red, or about 1,250 deg. F., maintained at this temperature for about 30 min. and then quenched in tepid water. It has been found that by far the best results are obtained by dropping the entire casting in a large vessel of water. It is not sufficient simply to pour water on the heated metal.

A sound weld made under these conditions will give satisfactory results where an unusual amount of strength in the welded part is not required. It has been mentioned that at the present stage in the development of welding technique for manganese steel there is a zone of weakness between the weld metal and base metal which does not respond readily to heat treatment after the weld is completed. Sound welds, however, should be entirely satisfactory from the standpoint of shock and wear, which, as a matter of fact, is the prime reason for using this alloy.

The General Electric Co. has recently placed on the market a newly-designed automatic electric arc welder described as follows:

The new welder starts the arc by first touching the electrode to the work and then withdrawing it, thereafter maintaining a constant arc length by feeding the electrode wire to the weld at the exact rate of speed necessary to replace the electrode fused into the weld. It is claimed that the new equipment will perform these operations more rapidly and with a greater degree of accuracy than is possible by the most expert hand operators.

The automatic welding head incorporates the necessary mechanism for feeding the electrode to the arc, and consists essentially of a pair of feed rollers geared to a constant speed motor through a magnetic clutch. The gearing and feed mechanism are contained in one housing, to which the motor is bolted.

The feed rollers feed the welding wire through the nozzle to the arc. The distance and pressure between these rollers is readily adjustable. Each welding head is equipped with a set of nozzles for 3/32-in., 1/8-in., 5/32-in., 3/16-in., and 1/4-in. wire.

The speed of wire feed may be adjusted by means of a selective gear changer which permits the gear ratio to be altered at will to adapt the speed of the feed rollers to the size of wire and the welding current used. Three gear speed changes can be made by moving the gear shift pin which extends from the rear of the gear housing. An additional finer adjustment can be made by means of a rheostat in the field of the motor.

Provision is made for pointing the electrode backward or forward in the line of weld, and also for moving it sideways. The pointing of the electrode is obtained by rotating the head on its horizontal shaft, and the lateral movement by means of the handwheel on the front of the head.

The control equipment consists of a control panel, a meter panel and a push-button station. The control panel mounts the main line contactor for the welding circuit and two smaller contactors for interlocking the travel motor with the arc. By means of auxiliary contacts, the line contactor controls the starting and stopping of the feed motor. The magnetic clutch is operated forward or backward by a voltage relay, the coil of which is connected across the arc. Thus the electrode is fed to or from the work automatically, adjusting itself to any irregularities in the surface of the work. One rheostate controls the speed of the feed motor and the other controls the voltage setting of the arc.

The new automatic arc welder will be sold either separately (where the user constructs his own clamps) or as part of a complete welding equipment including the necessary clamps and framework for holding the work. It will find its principal application in the construction of such standard products as pipe, tanks, boilers, cans, automobile axle housings, etc., where the welding operation is constantly repeated as part of a regular production schedule.

New Insulating Brick

A NEW "Sil-O-Cel" insulating brick, called "Super Brick," made of semi-refractory material and suitable for use where temperatures behind the refractory may run as high as 2,500 deg. F., was placed on the market during the past year by the Celite Products Co. These brick are free from perceptible shrinkage and not affected by acid gases or fumes.

This new brick contains a high percentage of tridymite, a form of silica that is very stable and uniform at high temperatures and which has also a very uniform expansion curve, making the brick practically immune from spalling caused by rapid changes of temperature.

This brick is made from an extremely pure form of amorphous silica. The low thermal-conductivity of this material results from its natural structure of myriads of cells of microscopic size constituting more than 70% of its volume. Being essentially silica, its chemical composition does not change.

The conductivity of this new brick is very low; the weight is 40 lb. per cu. ft.; crushing strength 325 lb. per sq. in.; melting point 2,835 deg. F.; and it is made in dimensions 9 in. by 4½ in. by 2½ in.

These new "Super Brick" are not intended to displace the "Sil-O-Cel Standard" and "C-22 Insulating Brick" made by this company, but are rather to widen the scope of insulating construction.

Gypsum Producers Consolidate

IT is reported that a consolidation of the Beaver Products Co., Inc., of Buffalo, N. Y., and the Southern Gypsum Co. of North Holston, Va., will be in effect January 1, 1927.

The Southern Gypsum Co. properties include a very large supply of gypsum rock, mined at unusual depths, there being levels of 100, 200, 300 and 400 ft. The plaster mill at North Holston is one of up-to-date equipment of large capacity, and includes a mill for making gypsum block, or partition tile, and one for making gypsum lath, a backing for plaster.

The Southern Gypsum Co. has been supplying plaster and other gypsum products to the entire Southeast for many years. Combined with the sales and service facilities of the Beaver Products Co., Inc., a still broader and more complete service to the trade will doubtless be effected.

Penn-Dixie Officials Make First Inspection of Northern Mills

THE officials of the recently organized Penn-Dixie Cement Corp. made their first inspection of the northern group of cement mills included in the merger. These comprise the plants of the Dexter Portland Cement Co. at Nazareth, Penn., and those at Bath, Penn., and Portland Point, N. Y., of the Pennsylvania Cement Co.

The party making the trip shown in the accompanying illustration and from left to right are: George Kilian, John B. Dennis, Jansen Noyes, S. A. Russell, John A. Miller, president of the Penn-Dixie company; Richard Hardy, chairman of the board; Morris Fortuin, T. R. Preston and Ellis Soper, consulting engineer.

Group of Penn-Dixie Cement Corp. officials on initial inspection tour of the company's northern mills

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

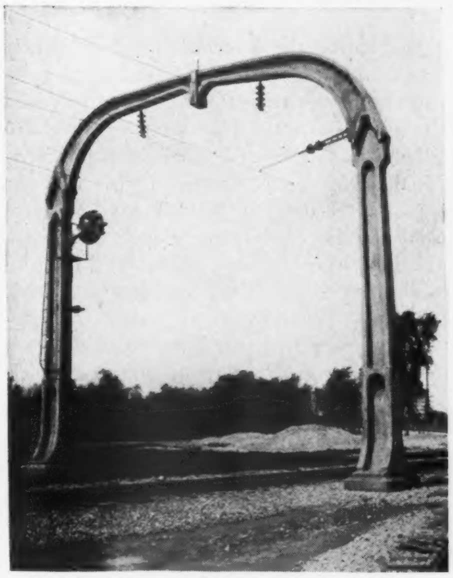
Biggest Year for Concrete Products Drawing to a Close

THE achievements of the present year in the manufacture and marketing of concrete products are of unusual interest.

Several past years have seen large gains, probably due in part to abnormal demand. Conditions this year were considerably different, with the building shortage generally absorbed and even a surplus of dwellings in some places. Competing materials conducted spirited campaigns for business, not infrequently directing their efforts pointedly against concrete products.

Notwithstanding these circumstances, concrete building products, including block, brick, tile, architectural stone, roofing tile and prepared stucco, moved in greater quantities than during any preceding year. In 1925, the total block and building tile shipped was equal to 605,000,000 standard block, according to best available estimates; the 1926 output will not fall under 650,000,000 and in all probability will reach the vicinity of 675,000,000 block, which is equivalent to approximately 875,000,000,000 common brick. The concrete common and face brick output should add shipments totaling around 350,000,000 brick, according to current estimates.

While these figures are gratifying, it may be pointed out that the average daily production of block and tile per plant is still much smaller than it should be. With around 7500 factories, all told, the output per day on a 250-day per year basis is only 360 block, a very low figure indeed.



Pre-cast concrete arches for supporting overhead trolley wires on the electrified D. T. & I. railroad

The gains which have been made in output year after year must be looked upon as very satisfactory, although they are far less significant than progress made in several other directions. The industry has great reason to feel proud of the rapid increase in the practice of periodically testing concrete wall units. A number of the leading manufacturers voluntarily started regular testing at intervals, in order to keep informed as to their quality, protect themselves in case of dispute and be in a position to advertise and guarantee tested quality. Similarly, a large number have contracted for the Underwriters' Laboratories testing service. This development is a splendid evidence of good faith to building inspectors and the building public and is bound to bear abundant fruit.

Another extremely satisfactory indication of progress is the granting by insurance rating bureaus of more liberal rates on concrete masonry building. During the past year, concrete masonry for dwelling construction was given the same rate as solid brick in the states of Alabama, Florida, Georgia, Illinois, Iowa, Louisiana, Nebraska, North Carolina and Virginia, as well as suburban territories surrounding New York City and Philadelphia. In New Jersey, Tennessee and the District of Columbia these rates were

Putting in reinforced concrete sewer pipe in Chicago, and at right, part of a large cement pipe plant at Niles Center, Ill.


Concrete block structures withstood the violence of the recent Florida hurricane, though directly in its path. Some idea of the storm's devastation may be observed by the trees which were broken off close to the ground

in effect previously. More equitable rates were granted on all classes of mercantile and industrial structures in the southeastern states this year.

Successful fire tests on the "Stone-Tile" type of concrete unit were recently conducted at the Underwriters' Laboratories, in which the behavior of the material, even that made of silicious aggregates, was excellent. Similar tests are to be made soon on other types of concrete building tile, in order to demonstrate scientifically the high resistance to fire which they have shown so repeatedly in field demonstrations and under actual fire conditions.

As a result of continued general improvement in quality and standardization of products as well as the application of better selling methods, most interesting gains have been made in the field of large residence, country estate and apartment house construction. Buildings falling under these classifications have absorbed a large production of building tile and block for both bearing walls and partitions. These structures frequently use 60,000 or more block each. Many of the finest homes erected during the past year in eastern, southern and California cities have employed concrete masonry exclusively.

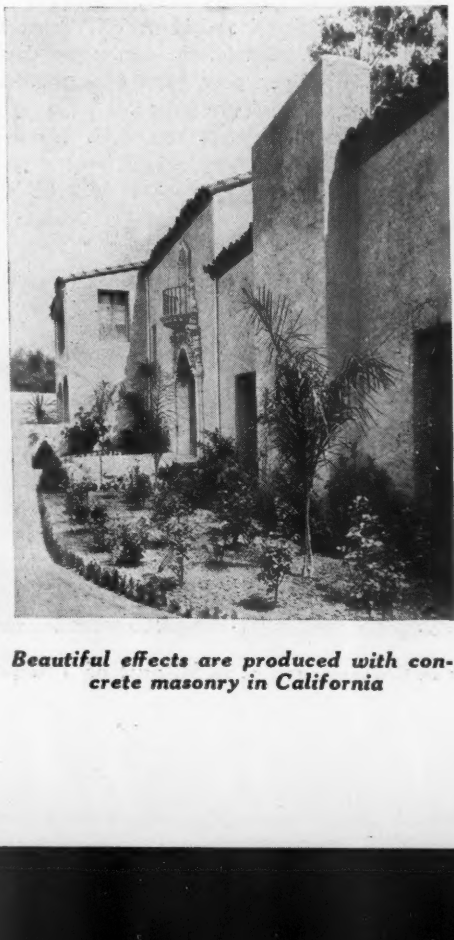
Coral Gables Fine Example

The most striking example in the entire Florida storm area of good construction undamaged is found at Coral Gables, where there is a group of about 3500 residence, apartment and hotel structures, all of which have concrete block walls clad with artistic colored cement stucco. These buildings, erected under the supervision of the Coral Gables architects, in accordance with the U. S. Department of Commerce building code, came through the storm without a single case of destruction or anything more serious than slight superficial damage. These houses were directly in the path of the hurricane, as shown by the fact that trees and landscaping in the town were damaged to the extent of over a million dollars.

Judging by the devastation to buildings in communities surrounding Coral Gables on every side, the property losses prevented by the use of substantial concrete masonry and adherence to the well recognized standards of the Hoover committee easily may be placed $25,000,000 to $50,000,000 for Coral Gables alone. While the clay brick propagandists have striven valiantly to make capital out of the Florida catastrophe, brick construction was so sparsely used throughout the storm area that it was hardly a factor. Few samples of undamaged brick dwellings have been pointed out to the public by the clay brick association, although the latter organization had a specialist scouting around Miami for promotion material.

Technical Studies Continued

Important technical studies, focusing particularly on problems involving efficiency of block and building tile manufacturers, are being actively conducted. Committee P-1 of the American Concrete Institute has recently manufactured a large number of experimental tile, under a variety of carefully controlled conditions, these tile being turned over to the University of Michigan for study and testing.



Beautiful effects are produced with concrete masonry in California

The building department of Springfield, Mass., has recently made an important contribution both to available technical data and to practical methods of enforcing requirements for materials used in building construction. This is being accomplished by testing a large proportion of the building units of all kinds being used in that city. The tests made so far have not only showed that concrete units were generally exceeding requirements but they have made it necessary for competing materials to improve considerably in order to remain in the market. The building department's compression tests on concrete masonry wall panels have shown the usual high ratios of strength between complete panels and individual units.

A Year of Changing Trade Conditions

The trade situation in the eastern part of the country, so far as concrete building products are concerned, was marked by the consolidation of the leading cinder block manufacturers, now operating some 20 plants. Negotiations are now under way for the acquisition of at least an equal additional number. In the Brooklyn area, always noted for a large number of small factories, some 30 plants have gone out of business mostly as a result of good building code enforcement.

An attempt by the Common (clay) Brick Manufacturers Association to use the name and prestige of the American Society for Testing Materials in a ridiculous campaign designed to make people believe that only clay brick are "brick" resulted in a well-earned rebuke for the clay enthusiasts and a good laugh from the public. During the year the U. S. Department of Commerce Building Code Committee was attacked from

the same source because, after considering ample data, it gave concrete units proper classification in its code. The committee stood by its findings.

An outstanding development around Chicago was the rapidly growing market for manhole and catchbasin block. Several large factories are now turning out these block night and day. The year's output in the city and suburban area will probably exceed 2,500,000 circumferential block. In other cities these block are being rapidly introduced, their obvious economy and superiority in construction making ready friends.

The successful entry of concrete sewer pipe into the city of Chicago, perhaps the most promising market in America, is one of the high points in the records of the year's progress. The establishment of a large factory in Chicago for the production of both machine-made and cast pipe led to placing over half a million dollars' worth of reinforced sewer pipe in Chicago suburbs. No doubt the fine appearance of these large quantities of concrete pipe in the vicinity had much to do with convincing the city officials. The first concrete sewer pipe were laid in Chicago on September 8. Engineers are pleased with the material being furnished.

Many other cities opened their specifications to concrete pipe or liberalized the conditions of their use in 1926. New Orleans now uses concrete pipe very largely for all diameters over 1 in. and Fort Worth for diameters over 24 in. The city of Houston is also favorable to concrete, having spent large sums in replacing clay with concrete pipe during the past five years. The Michigan and the California cities as well as municipalities from New England to Florida and to Seattle have combined to make 1926 pipe shipments exceed a million tons. The country is now well covered with large capacity plants.

Model home erected by the Indianapolis "News" at Indianapolis, Ind.

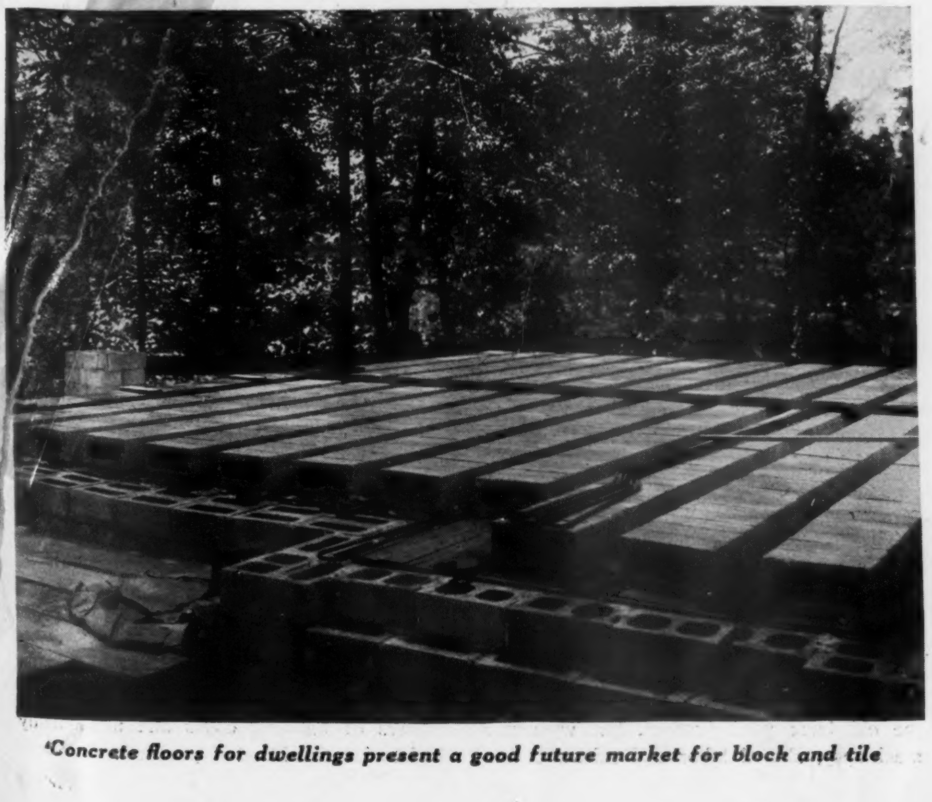
Unusual interest has developed during the year in the introduction of precast concrete street curbing. This material, made of 3000 to 4000 lb. concrete heavily reinforced, has been found less expensive and more satisfactory than natural stone in the western New York and Louisiana cities, where it has been tried out. City engineers are enthusiastic over this product because of its trueness to shape, uniform quality and ease of laying. A greatly extended market may be expected during coming months.

Accessory Products on the Increase

Precast terrazzo products, frequently referred to as "Art Marble," have had a most encouraging year. This refers particularly to the high grade terrazzo floor tile, wainscoting, base and casing material used in the interiors of office and public buildings, churches, schools, hotels, apartments and clubs in the largest cities. There is still a wide range of quality in this material and manufacturers still are forced to sell their products on the individual merits of each particular factory.

Manufacturers of cast stone for exterior architectural use report an excellent year. The Benedict Stone Corporation, with plants at New York, Montreal and Chicago, has completed several of the largest jobs in the country, including the Chicago Stadium, the biggest cast stone job ever let and one of the biggest stone faced structures ever built. The Onondaga Litholite Co. of Syracuse is also completing some very notable work and has recently received wide acclaim for a number of entirely new brushed surface effects, some of which closely simulate those of eastern seam granite. One of the most noteworthy of the moderate size jobs of the year is the Eagles' Temple at Milwaukee, the entire exterior being of cast stone supplied by the Plastic Products Co. of Milwaukee. The ornamentation includes a frieze of life sized figures.

Sales of concrete roofing tile have shown encouraging increase in many of the better markets. Chicago again tops the list and will probably show sales exceeding 25,000 squares for the year. St. Louis shows a large gain, as do the San Francisco and Los Angeles districts. The market for such accessory products as laundry trays, garbage boxes, meter boxes, burial vaults and septic tanks has remained strong with a slightly increased output, but the margin of profit in these lines seems to remain too small to offer either encouragement or security against possible reverses.



Concrete floors for dwellings present a good future market for block and tile

Canadian Manufacturers Have Good Year

The most recent actual statistics on the concrete building products industry in Canada, covering the year 1925, have just been made public, showing that the value of products sold amounted to $2,020,239, an increase of 61% over the previous year during which sales amounted to $1,257,871.

One hundred and ninety-seven factories reported shipments which combined to give the above total. These figures are quoted from the official records of the Dominion Bureau of Statistics at Ottawa.

The factories reporting their output represent an investment of $2,594,736. Of the total 197, 148 are in Ontario, 34 in Quebec, five in New Brunswick, four in British Columbia, three in Alberta, two in Nova Scotia and two in Saskatchewan. Since 1921 the number of plants has increased from 108. The greater number of the Ontario members belong to the Ontario Concrete Products Association and local associations function more or less actively at Toronto, Hamilton and Windsor. Quebec manufacturers located around Montreal belong to the Quebec Concrete Products Association.

Probably the present year is more notable for improvement in manufacturing practice than for increase in sales, although the final figures undoubtedly will show a moderate gain. Modern machinery was installed in a number of plants, increasing the production considerably in Toronto and other Ontario markets.

Outlook for Next Season

Manufacturers of concrete block, brick and tile throughout this country and Canada apparently look for a volume of business in 1927 equal to, or perhaps slightly in excess of, that enjoyed in 1926. The market for dwellings is expected to shrink considerably in some sections, but on the whole may be capable of absorbing block, brick and tile in approximately the same quantities as this year. On the other hand, concrete wall materials are in stronger demand for industrial and mercantile building, while their position in the foundation market will probably be as good as for this year. A shrinkage in volume of building under four stories would not be unexpected, but unless it should become quite pronounced the usual gains in the proportion of the total going to concrete masonry will probably balance the shrinkage in the general building total.

Concrete roofing tile apparently has a big year ahead at all points where the business is carefully managed and quality maintained. New roofs in increasing numbers carry the concrete material; old roofs wear out and must be replaced irrespective of the demand for new buildings. The work of cultivation in many markets is just beginning to bear fruit and may be expected to yield increasingly in 1927.

Cast stone is in great demand wherever a first quality product is available, while a good market continues in the smaller places for good but less pretentious grades. Portland cement stucco as represented by a variety of attractive textures is strongly on the ascendency, not only for residence work but for schools, churches, stores, warehouses, factories and office buildings. New established prepared cement stucco plants in 15 of the largest cities will be supplying the market in 1927. Some of these plants which commenced operation during the last few months are already on a profitable basis. Every concrete products manufacturer who maintains a building organization would do well to look into the possibilities of the prepared cement stucco business at once. Almost every city in the country presents a splendid opportunity to overcoat old buildings, put commercial fronts on old residential structures and popularize concrete masonry clad in stucco.

Concrete sewer pipe will again be in strong demand in 1927 and it may be desirable to warn prospective manufacturers attracted by the outlook to proceed with the utmost care if at all. So many distressing failures with large losses have occurred among concerns breaking into this field without adequate commercial and technical advice that this warning will not be out of place. Present manufacturing capacity in all of the various territorial divisions is considerably in excess of production, although this factor is steadily improving.

The large railways will use a greatly increased volume of precast concrete during 1927, according to reliable estimates. Their general prosperity during the past two years is about to be reflected in extensive programs of new roadway and station building, terminal extensions and dockage facilities. During 1926 one large system installed a large concrete block factory in order to supply its own material for new stations and other buildings, although most of the roads seem to favor the policy of purchasing material as required from local concrete products factories. Poles, piles, culvert pipe and special units for right-of-way use are likely to be in strong demand through the Mississippi valley territory.

Further Notes on the Products Industry in 1926

TABULATION of the incorporation notices published regularly in Rock Products reveals an incomplete list of 147 new companies formed to manufacture cement products. The total capital incorporated for about $17,050,000. These figures do not include those which gave no capital value nor do they show the enterprises which were not listed as incorporations, of which there were undoubtedly many. Comparing these results with similar statistics for 1925 (157 companies with incorporation total of $11,487,000), it is evident that the companies entering the industry have stronger financial backing.

Great Improvements in Quality

The "one hoss" producer is fast going on his way. He is being replaced by the man who is making a product which is uniform in quality and guaranteed to meet the requirements of the accepted building code. The present-day producer has had a hard time to live down the poor reputation of the old back yard product, but with real machinery, skilled labor and scientific control in mixing and curing, he has established the cement block as a standard and reliable building unit.

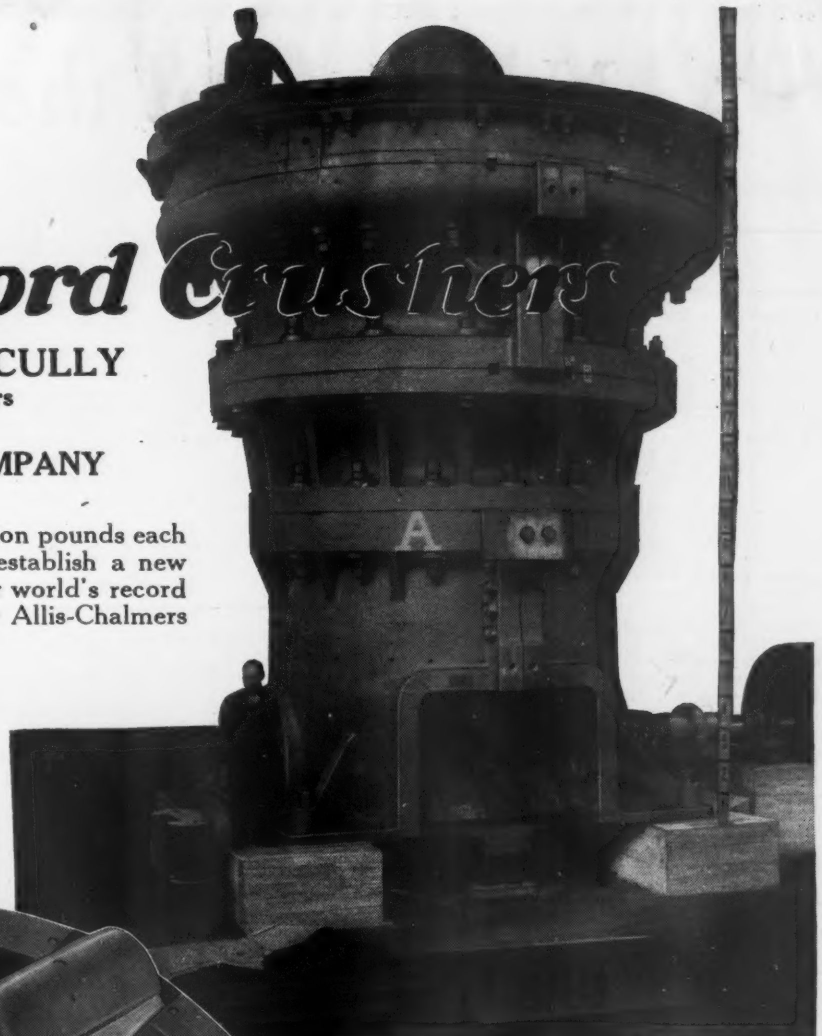
A great deal of credit must be given to the various products associations. Much of the research work and advancements in manufacture besides the helpfulness in "putting across" cement products could never have been accomplished without some sort of a centralized body. Standardization of size and quality have been their constant object and many of these associations now issue certificates to qualifying members, which testify that their product has been tested and found to meet these requirements. This is in the form of a guarantee and helps considerably to cut down sales resistance. Co-operative advertising is another feature introduced by the associations. Competition is maintained, but on a much fairer basis—between quality products. And a united front is presented to the producer whose products are below standard, which means that eventually he must either meet the requirements or get out of business.

Single Types the Rule

As a general rule most of the plants specialize in one particular type of product. That is the plants which produce cement block devote almost their entire efforts to that end. Particularly is this true in the larger cities where cement pipe, brick and tile plants are individual enterprises. In the agricultural regions, the products plant make specialties such as septic tanks, silo staves, corncrib parts and many other items in addition to ordinary block and tile. The aggregate used in manufacture is chiefly sand and gravel, but in special instances where ornamental art objects or trim stone were produced limestone screenings are much in favor. There are several reasons for this preference, one being that the stone product so made is closer grained and can be worked much after the fashion of the natural limestone, and the white color of the aggregate is a desirable quality.

Standard Sizes Needed

Although much effort has been expended in the past and even at the present time, there still remains unsettled the question of a regular standard size for block and tile. Producers in the same locality will make as many as 10 different sizes; in fact it seems that the dimensions are made to suit the fancy. This presents one of the most serious difficulties in marketing and if the concrete building units are to compete successfully with common brick some definite standard size must be agreed upon. In other words, the cement block and tile must be put on a business basis and in that way a greater impression will be made on the prospective purchaser, the architect and the engineer. Further, it will furnish a definite basis for the insurance underwriters, and makers of building codes and undoubtedly lead to increased use of products.



World's Record Crushers

60-INCH SUPERIOR McCULLY

All-Steel Gyratory Crushers

Built for

CHILE EXPLORATION COMPANY

Chuquicamata, Chile

These two crushers, which weigh a million pounds each and which are of all-steel construction, establish a new record for Gyratory Crushers and another world's record for the lines of heavy machinery built by Allis-Chalmers Manufacturing Company.

In spite of their extreme size and enormous weight they are sectionalized for transportation over a narrow gauge, mountain railroad to an altitude of 1¾ miles above sea level.

25 freight cars are required to handle the shipment of these two crushers and their spare parts between Milwaukee and New York.

The two hopper openings, each 5 feet across, permit a carload of ore weighing 70 tons to be dumped into the crusher at one time. Some pieces of the ore will weigh as much as seven tons. This will be reduced to a 12-inch product. Each crusher handles from 2000 to 2500 tons of ore per hour.

"The Story of the World's Record Crushers," a pamphlet telling of the problems of building and transporting these huge machines will be furnished on application to those interested. Address

Allis-Chalmers Manufacturing Co.
Dept. C-10 Milwaukee, Wis., U. S. A.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

News of All the Industry

Incorporations

Victor Sand Co., Camden, N. J., $160,000 preferred and 16,000 shares common, no par. William J. Dubler, M. L. Dubler, Vernon P. Ward, Camden. (Filed by New Jersey Corporation Guarantee & Trust Co., Camden.)

Peapack Limestone Products Co., Peapack, N. J., $100,000. Alice A. Sprague, Marguerite B. Sprague, Ezra Sprague, Peapack. (Attys., Lehlbach, Johnson & Ormond, Newark.)

Panel-Built Construction Co., Glendale, Calif. Dr. C. G. Snow, E. J. Phelan, Henry G. Johnson and James G. Cortelyou, all of Los Angeles.

General Cement Products Co., Magee Bldg., Pittsburgh, Penn., $1,000,000. Robert G. Campbell, John E. Crawford and C. J. Herzog.

James Sand and Gravel Co., Johnsonville, Tenn., $75,000. J. E. James, R. D. Herbert, Don James, T. L. Herbert, Jr., and H. H. Horner.

White Crystal Magnesite Co., San Francisco, Calif., $150,000. F. A. Alexander, J. M. Staples and L. P. Fogarty.

Red River Crushed Stone Co., Dover, Del., $200,000. Asphalt, limestone, stone. (United States Corp. Co.)

Marquette Cement Manufacturing Co., La Salle, Ill., increased capital stock from $7,000,000 to $10,000,000.

Missouri Portland Cement Co., St. Louis, Mo., increased capital stock from $6,000,000 to $9,000,000.

E. F. Fletcher Co., 990 W. Drayton St., Ferndale, Mich., $4,000. To engage in the stone business.

Colbert Lime Rock Asphalt Co., Sheffield, Ala., increased capital stock from $150,000 to $500,000.

Atlas Tile Co., Kansas City, Mo., $12,000. R. E. Martin, 715 Commerce Bldg., Kansas City.

Shell Island Products Co., New Orleans, La., $250,000.

Quarries

S. W. Dolan and **P. W. Riley** of Miami, Fla., and associates are reported to have acquired 1000 acres on the Hillsborough river in Pasco county and will mine rock deposits.

Atlas Rock Co., Oakdale, Calif., is reported to have closed down its plant, after a two-year run, for repairs.

Sunset Rock Products Co., 6372 Hollywood Blvd., Los Angeles, Calif., is about to build an addition to its rock bunkers at 10731 Bradford Ave., San Fernando annex, to cost $1,700.

Cisco, Texas—The Missouri-Kansas-Texas railroad, according to a report, is contemplating the development of the rock deposits north of Cisco for use as ballast on its Texas Central line. C. M. Aycock, engineer for the railroad, recently made a topographic map of the region. C. H. Van Eman, a Cisco contractor who has leases on the land containing the rock deposits, is said to be figuring with the railroad on development of the quarry.

Indiana Limestone Co., Bloomington, Ind., is reported to have had its three-story Walsh storeroom, located at Oolitic, near Bedford, Ind., destroyed by an explosion and fire, which followed, on Sunday afternoon, December 12. The loss is estimated at $100,000. Efforts are being made to determine the cause of the explosion. No one was injured in the blast.

Sand and Gravel

Crescent Gravel Co., Hersey, Mich., is reported to be planning on making extensive repairs and additions to its plant during the winter months.

Bedford-Nugent Co., Evansville, Ind., has installed a new crane at its plant at Rockport, Ind., which is capable of taking care of about 15,000 cu. yd. of gravel per day. The machinery was purchased at Muscle Shoals, where it was used but a short time.

Consumers Rock and Gravel Co., 2600 South Alameda St., Los Angeles, Calif., is erecting a 15x28-ft. storage building at 957 North Orange Drive, to cost $4,500, it is said.

Joe Erickson and Herman T. Anderson have engaged in business at Reseda, Calif., as the Reseda Rock and Gravel Co.

John Van Alstine has succeeded to the entire business of the sand and gravel firm of Van Alstine & Farrier, in Ellensburg, Wash., it is reported.

Columbia Contract Co. is putting in sand and gravel bunkers at 294 East Salmon St., Portland, Ore.

Kansas City, Mo.—The Kaw Valley Drainage Board here has acquired a nine-acre tract of land located along the Kaw river between 17th and 18th Sts., running north to Pawnee Ave., on which, it is reported, a sand plant will be erected. The property was purchased from Harry W. Lytle for a consideration of $6,500.

Lime

Superior Lime and Hydrate Co., Pelham, Ala., is said to have plans to install four new kilns in its plant, as well as other equipment for hydrated lime production, within the immediate future. The extensions will cost approximately $75,000. H. G. Bridgewater is president.

Mountain Lime Corp., New Haven Junction, Vt., recently purchased a No. 3 Clyde lime hydrator and weighing hopper and scale and additional machinery for a hydrating plant.

Roche Harbor Lime and Cement Co. announces that hereafter all its products will be distributed in a wholesale way in northern California by the Pacific Lime and Plaster Co., which has its main office at 58 Sutter St., San Francisco, Calif.

Marlbrook Lime Co., First National Bank Bldg., Roanoke, Va., plans installing a gyratory crusher and will add 10 new cars to quarry equipment.

Canyon Lime and Cement Co., Granite Falls, Wash., is contemplating putting in a machine drill within the near future, it is said.

Gypsum

United States Gypsum Co., Chicago, Ill., is said to have been granted permission by the U. S. war department to build two dykes 40 ft. apart in Sandusky Bay near Gypsum, Ohio. A new office building, it is also reported, has just been completed by the Gypsum company on its property at this point just east of the plant.

Cement

Warrior Cement Co., Chattanooga, Tenn., has appointed the Carolina Portland Cement Co. as exclusive distributor in Birmingham and Jefferson county, Alabama.

Cuban Portland Cement Corp., Havana, Cuba, reports that in the Cuban hurricane disaster of October, 1926, which caused a property damage estimated at $100,000,000, about the only buildings that successfully withstood the ravages of the storm were those constructed of concrete. Windows and frames were torn out with the force of the wind, but the concrete structures remained undamaged. Incidentally, the company's two new concrete silos and reinforced concrete warehouse and packing plant were buildings that escaped damage.

Canada Cement Co., Ltd., Montreal, Quebec, has started work, it is said, on the erection of a plant at Lakefield, Ont., to comprise 10 buildings. The company will purchase material and complete equipment.

Missouri Portland Cement Co., St. Louis, Mo., is reported to have acquired 416 acres at Batesville, Ark., which are said to include limestone deposits, and contemplate the early construction of a new cement mill, to cost in excess of $1,000,000 with equipment. Quarry machinery will be installed for the development of the limestone lands.

Universal Portland Cement Co., Chicago, Ill., is said to have taken out a group insurance policy of $324,000 with the Prudential Insurance Co. of America covering its Duluth, Minn., plant employes.

Pennsylvania-Dixie Cement Corp. and the **Signal Mountain Portland Cement Co.** of Chattanooga, Tenn., have each donated 1000 bbl. of cement, it is said, to be used in the construction of the proposed Chamberlain stadium of the University of Chattanooga.

Southern Cement Co., Birmingham, Ala., has recently installed a dust collecting system at their plant at North Birmingham, Ala.

Cement Products

Hydraulic Art Stone Co., Libertyville, Ill., is reported to be building a cement block factory and drying plant near what is known in this locality as the Schroeder pit. The company expects to do a big business in cement blocks and cement products next spring.

Shearman Concrete Pipe Co., Knoxville, Tenn., reports that its machine shop was destroyed by fire December 1 with an estimated loss of $20,000.

Florida Stucco Products Co., Miami, Fla., of which Omar Abernathy is manager, will soon begin construction of a plant on the North Bay Road.

Weiss Brothers have engaged in the manufacture of cement tile in Central Point, Ore.

Topel & Madole, building contractors at Libertyville, Ill., will soon start the manufacture of cement products at a new plant which has just been completed at 131 West Ellis Ave. Machinery has been purchased and is now being installed preparatory to being placed in operation.

Talc

United Talc and Crayon Co., Glendon, N. C., of which J. S. Holland is secretary and treasurer, is installing machinery for the manufacture of talc and soapstone pencils.

Blue Ridge Talc Co., Henry, Va., has had a banner sales year for its mortar colors, it is stated. So that they can better handle this growing demand, the entire plant has just been electrified, and machinery is now driven by individual motor units.

Western Talc Co., Los Angeles, Calif., is making alterations to cost about $2,000 to its mill on the south side of East First St. and west bank of Los Angeles river.

Miscellaneous Rock Products

Birmingham Slag Co., Birmingham, Ala., reports that the new screening plant, which was built to replace the one destroyed by fire on October 25, has been in operation since December 3. The new structure is of steel construction.

Shell Island Products Co., recently organized at New Orleans, La., with a capital of $250,000, is reported to be contemplating the erection of a new plant for the production of agricultural lime and road materials, using oyster shells as a source of raw material. The plant will cost approximately $175,000 with crushing, pulverizing and other machinery.

Golding Sons Co., Trenton, N. J., plans erecting a new one-story feldspar grinding mill, according to reports. The cost is estimated at $50,000 with equipment.

Colbert Lime Rock Asphalt Co., Cherokee, Ala., is said to have purchased 1800 acres of lime rock asphalt land and to have plans under way to increase production at the quarry from 4 to 20 cars daily. The plant, it is also reported, is being electrified.

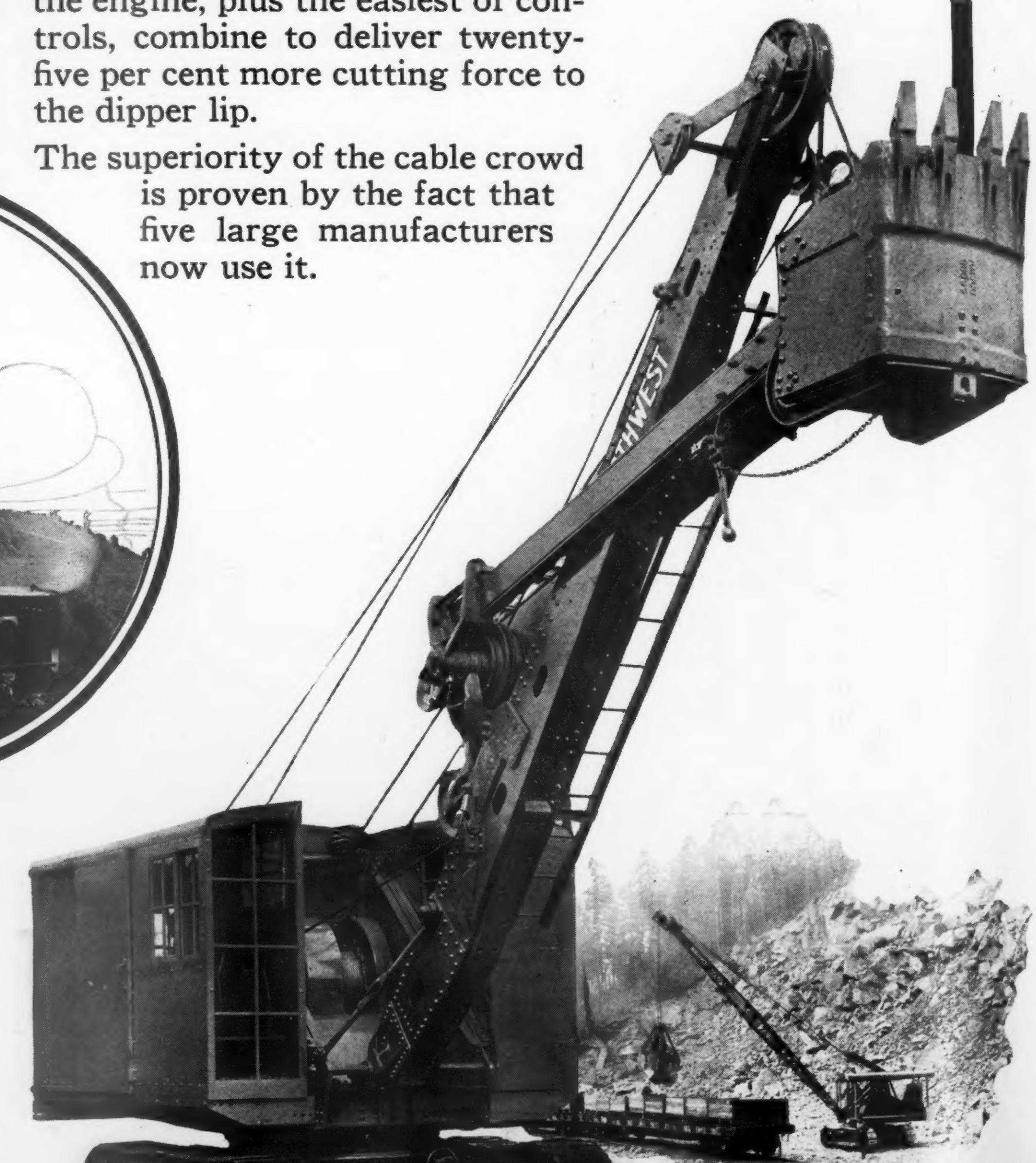
Obituaries

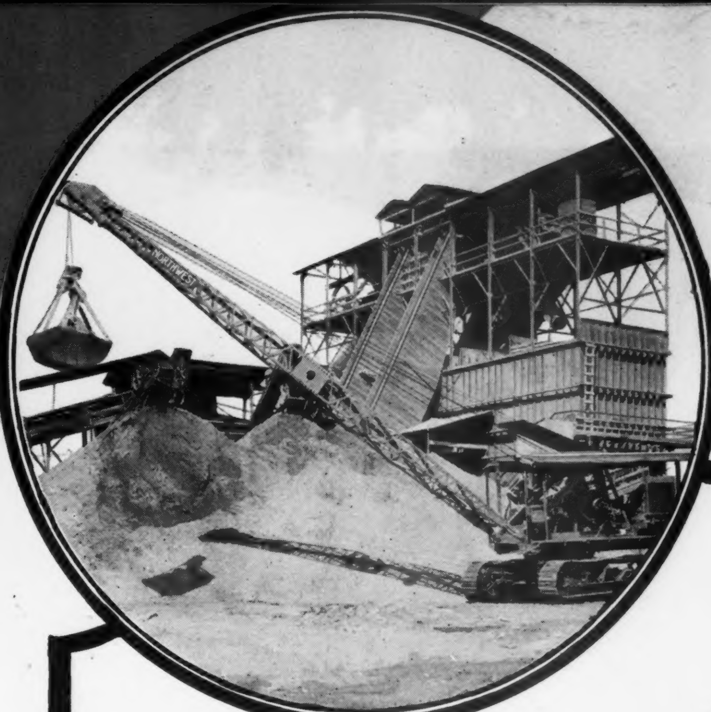
Thomas J. Neacy, president of the Beaver Manufacturing Co., Milwaukee, Wis., makers of gasoline engines, died on November 16 at the age of 78. Mr. Neacy was in good health and his death came as a surprise. His son, P. C. Neacy, who was formerly vice-president and general manager, has been elected president by the directors to succeed his father.

25% more cutting force

IT is cutting force that fills the bucket. The machine that stutters as it digs, dragging back over the bank for another try, is wasting time. With a Northwest there is no reduction of digging effort while thrusting, there are no chains to impose an extra load on shipper shaft bearings or backlash when shaking the dipper, there is no loss of friction in driving shipper shaft drums and there are no extra engines to add weight to the boom and demand extra attention. These facts and the high horsepower of the engine, plus the easiest of controls, combine to deliver twenty-five per cent more cutting force to the dipper lip.

The superiority of the cable crowd is proven by the fact that five large manufacturers now use it.





An All 'round Machine!

You want versatility in a machine, you want your shovel to earn a full day's pay every day!

The easy convertibility of the Northwest shovel and crane, the exceptional mobility, the easier operation resulting from the "feather-touch" clutch control—all these make the Northwest ideal for the pit and plant.

It can be quickly converted from a shovel to a crane without any changes in basic machinery, it is always ready to run and there are no stand-by losses, the expense of a fireman is eliminated, boiler troubles are unknown, and pit costs are reduced.

NORTHWEST ENGINEERING CO.

The largest exclusive builders of gasoline and electric shovels, cranes and draglines.

1734 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Ill.

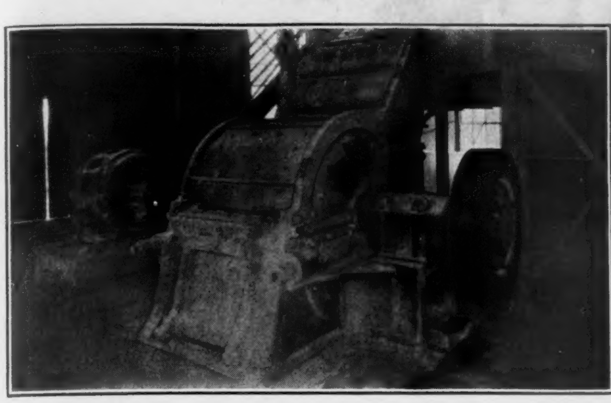
NORTHWEST

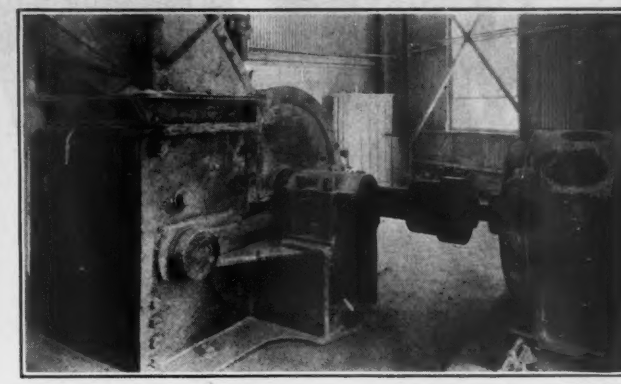
CRANES·SHOVELS CONVERTIBLE *and* DRAGLINES

Gasoline·Diesel·Electric

Mobility

A STANDARD DIXIE HAMMER-MILL INSTALLATION



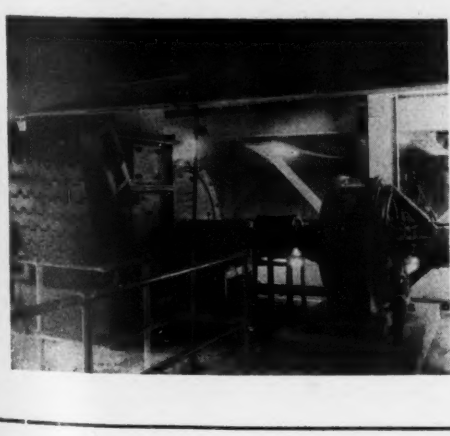


Dixie Mogul Non-Clog Hammer-Mill

Covered by Patents
Nov. 3, 1925
Nov. 2, 1926

Put your reduction Problems up to us.

DIXIE MACHINERY MFG. CO., 3680 MARKET ST., ST. LOUIS, MO.

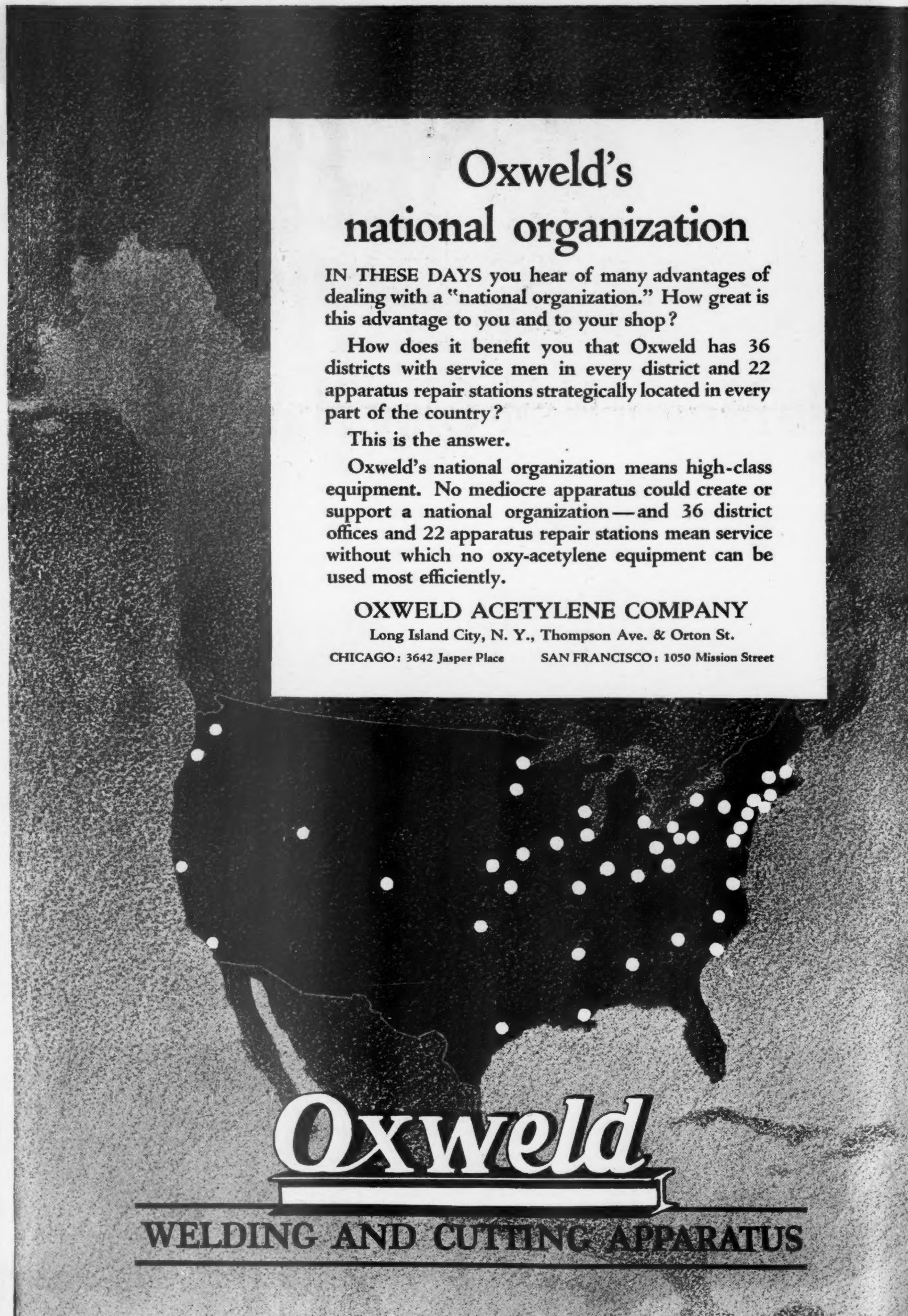


DIXIE
Mogul Moving Breaker Plate Hammer-Mills

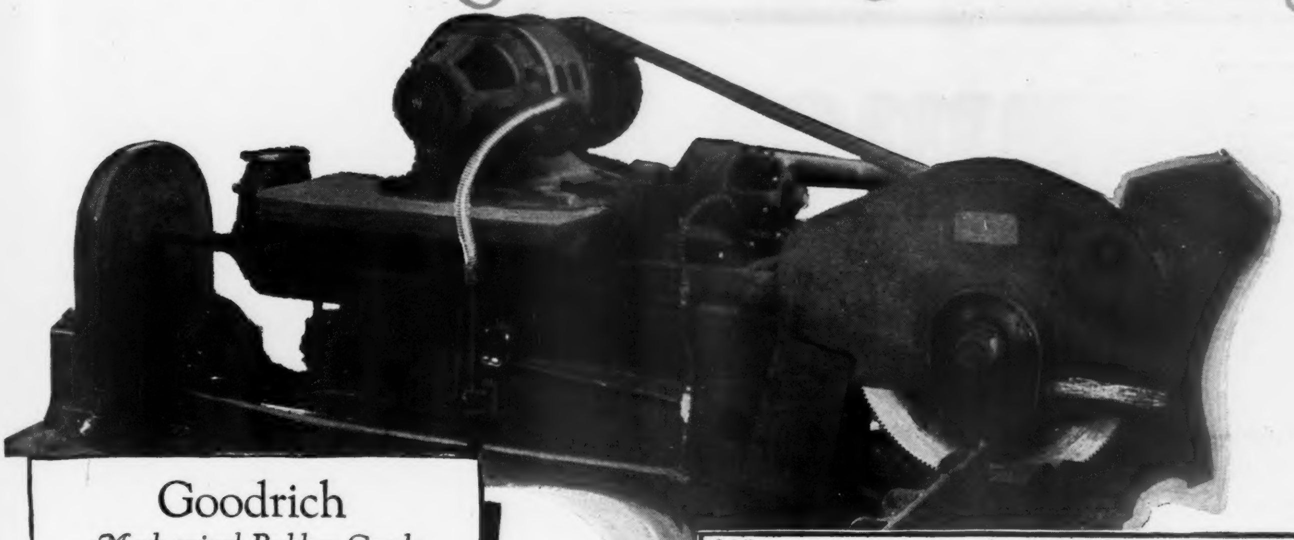
Only Crusher or Pulverizer made that handles wet or sticky materials.

WE ALSO MAKE STANDARD BREAKER PLATE HAMMER-MILLS

A DIXIE Cement Plant Installation


Oxweld's
national organization
IN THESE DAYS you hear of many advantages of dealing with a "national organization." How great is this advantage to you and to your shop?
How does it benefit you that Oxweld has 36 districts with service men in every district and 22 apparatus repair stations strategically located in every part of the country?
This is the answer.
Oxweld's national organization means high-class equipment. No mediocre apparatus could create or support a national organization—and 36 district offices and 22 apparatus repair stations mean service without which no oxy-acetylene equipment can be used most efficiently.
OXWELD ACETYLENE COMPANY
Long Island City, N. Y., Thompson Ave. & Orton St.
CHICAGO: 3642 Jasper Place SAN FRANCISCO: 1050 Mission Street
Oxweld
WELDING AND CUTTING APPARATUS

Belt-testing Drives of Industry



Goodrich
Mechanical Rubber Goods

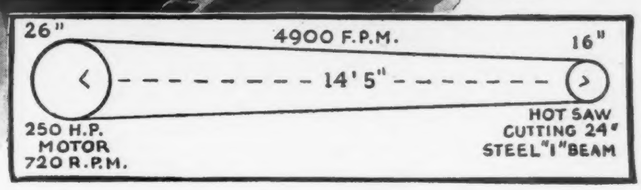
Performance Report 2100-19

From the Speck-Marshall Co.
207 Market St. Pittsburgh, Penna.

We supplied a local steel mill a 28" 7-ply Goodrich "1788" transmission belt, made endless at the factory, which was installed on a hot saw January 1. Previous to that time they had been using Hot Saw belts fastened with steel fasteners which gave an average service of about 30 days.

This was the first "1788" Endless belt they had tried. It has been operating continuously for nearly six months and is in excellent condition. It shows little or no stretch.

This is positively the most severe service we know of for a transmission belt.



The Hot Saw

Driving a saw cutting 24 in. steel girders, this Endless Goodrich "1788" belt has lasted six times longer than belts previously used. It is an example of what Goodrich belts, properly applied, are doing on hard drives in all industries—what they can do to help you solve *your* transmission problems.

THE B. F. GOODRICH RUBBER COMPANY
Established 1870 Akron, Ohio

Goodrich
Transmission BELTS
"Best in the Long Run"

Hammer Crushers

Handle Larger Rock **50% Less Investment**
Better Size Control **Lower Crushing Costs**

1926 saw more Williams Hammer Crushers installed in big plants than ever before.

The reasons why are plain. Handling larger rock they save much secondary shooting and sledging—save cost and upkeep of a primary breaker, scalping screen and extra elevator—permit use of smaller, less expensive buildings and less equipment is exposed to wear and tear. Size control is at least equal, usually more efficient than two or three step crushing. To reduce your investment 50% to 75% and add the above advantages, describe your work and let us tell what we are doing along similar lines.

The "Mammoth" crushes 48″ rock to 1¼″.

The "Jumbo" 24″ rock to 1¼″, ¾″ or finer.

The "Jumbo Jr." reduces one man size rock to 1¼″, ¾″, or agstone.

The "Universal" Pulverizer for Fine Grinding.

The "NON-CLOG" for Wet Rock.

Williams Patent Crusher & Pulverizer Co.

800 St. Louis Ave. St. Louis, Mo.

Chicago 37 W. Van Buren St. **New York** 15 Park Row **San Francisco** 415 5th Street

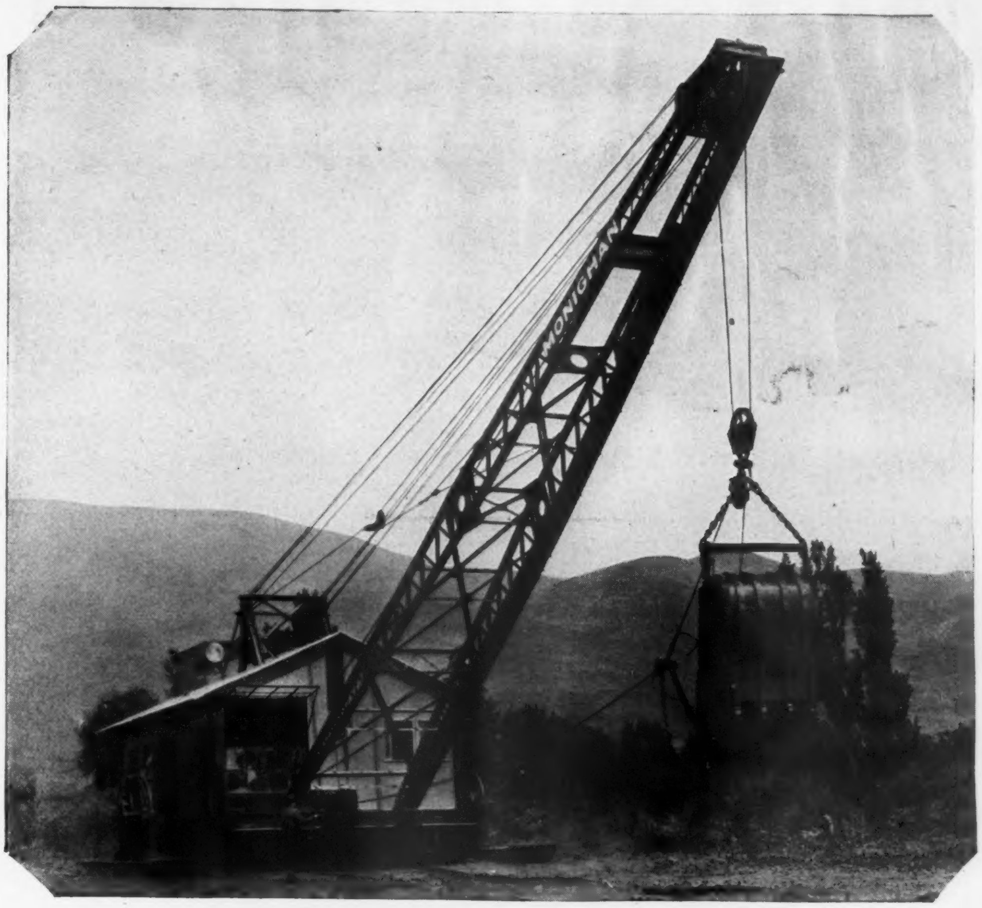
Williams

ORIGINAL PATENTEES AND WORLD'S LARGEST BUILDERS OF HAMMERMILLS

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. · TRADE MARK ·

REG. U.S. PAT. OFF.

PATENT CRUSHERS GRINDERS SHREDDERS



MONIGHAN

Walking Dragline Excavator

1. Lowers capital investment.
2. Economically strips heavy overburden for shallow deposits.
3. Digs much wider cuts.
4. Keeps always in the best operating position.
5. Side steps.
6. Makes sharp angle turns.
7. Moves and digs where other excavators would mire.
8. Revels in rough going.
9. Footing under traction treads may be replenished.
10. Supreme adaptability.
11. Built like a battle ship.

Monighan Walkers are made in 1, 2, 3, 4, 5 and 6 cu. yd. sizes

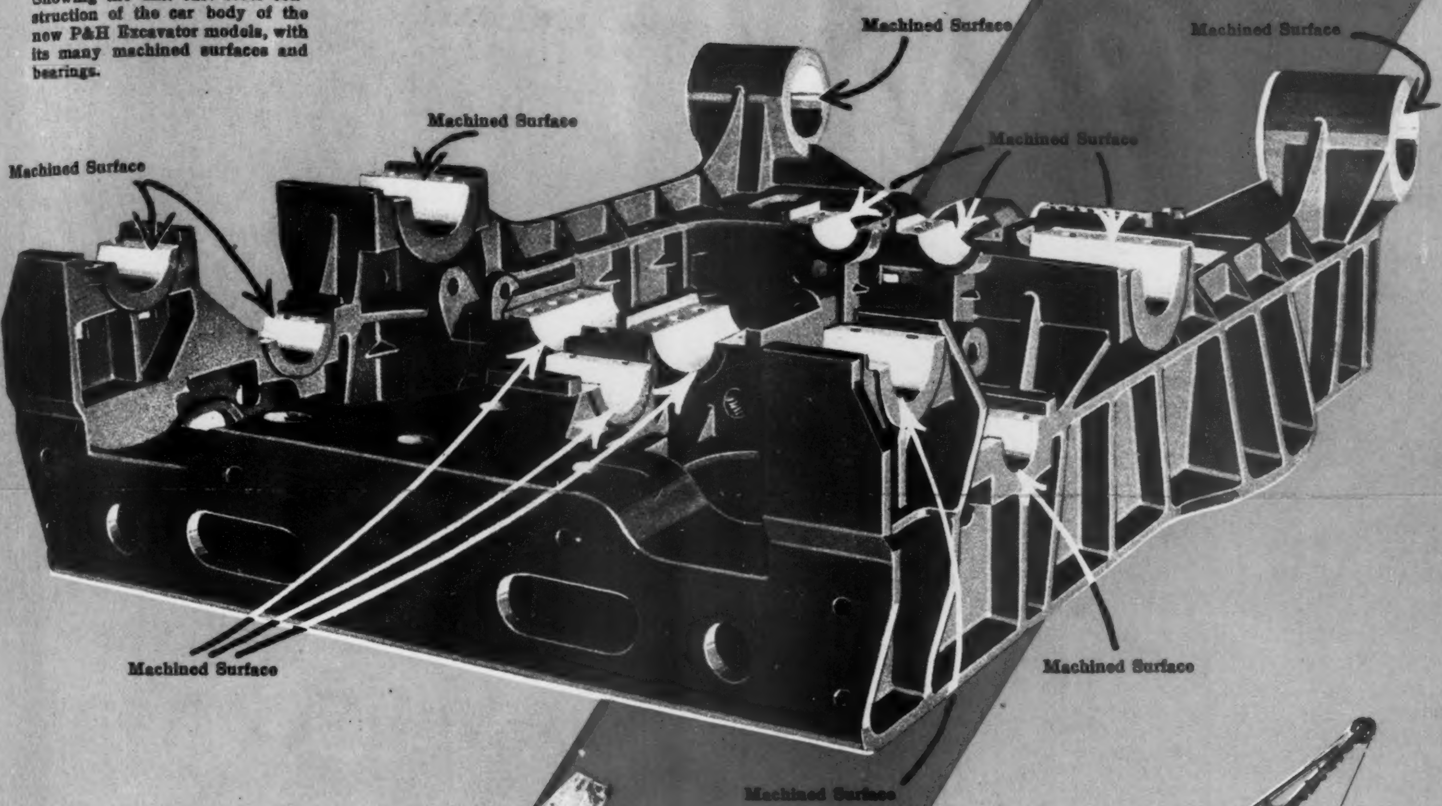
MONIGHAN MACHINE COMPANY

949 N. Kilpatrick Ave. **Chicago, Ill.**

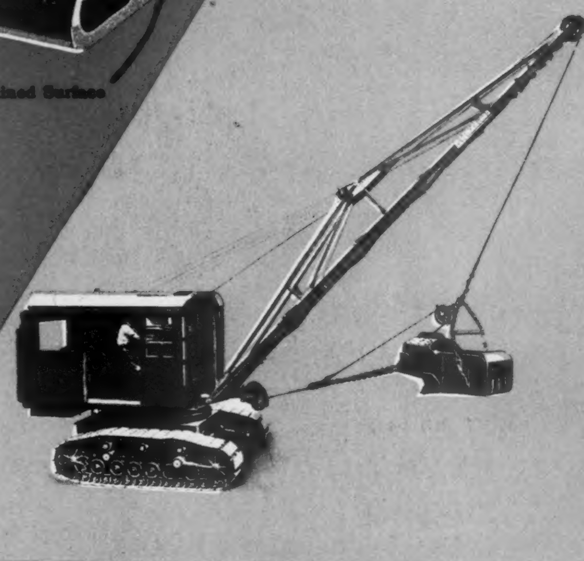
MONIGHAN

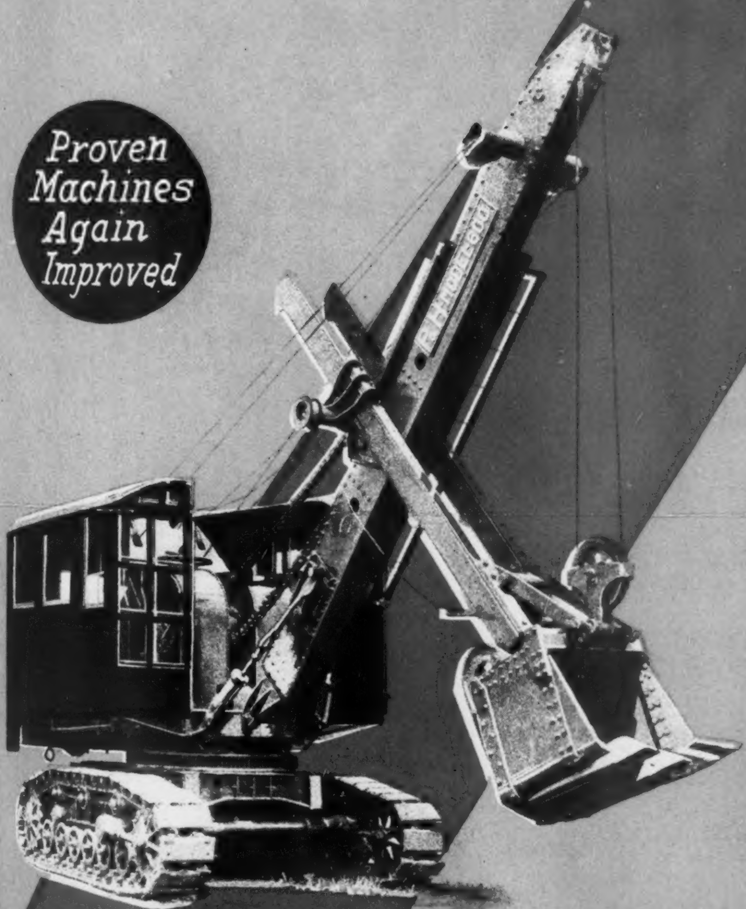
Unit Cast Steel Construction

Showing the unit cast steel construction of the car body of the new P&H Excavator models, with its many machined surfaces and bearings.



Proven Machines Again Improved





Shock and Strain-proof— Longer Life

Great single castings of steel give the New 1927 P&H Models tremendous, lasting strength. Care in the casting (done at our own foundries) and in the machining at all joints and bearing points (done in our own shops) insures perfect alignment and smooth operation for more years of dependable service.

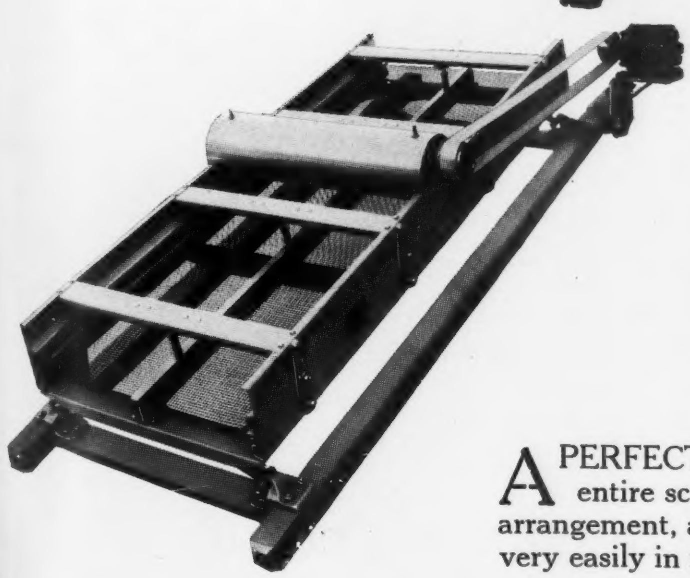
Models 400, 600 and 700 — made to fit the job — not stretched to meet it.

P&H EXCAVATORS

~ Built on a Foundation of Unit Cast Steel ~

NEW

IMPROVED TYPE "C" UNIVERSAL VIBRATING SCREEN



THE IMPROVED TYPE "C" UNIVERSAL VIBRATING SCREEN has all of the advantages of former models, with improvements in design and construction that places it **STILL FARTHER IN THE LEAD.**

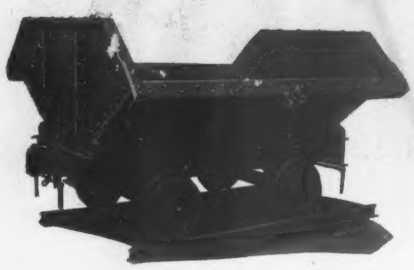
THIS improved model is constructed of pressed steel, the very strongest construction, and which also gives the very necessary light weight required in a successful Vibrating Screen.

A PERFECTLY uniform tension is maintained over the entire screening area, thru our new duplex clamping arrangement, and the screen cloth sections can be changed very easily in five minutes.

Let us send you a copy of our New Catalog No. 70 which describes this Vibrator in detail. Write today!

UNIVERSAL VIBRATING SCREEN CO.

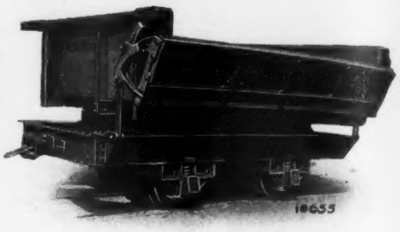
RACINE ~ ~ WISCONSIN



Phoenix Car
Patent Pending

ENGLAND

COMES TO



Won Way Car
Patent Pending

EASTON

FOR

QUARRY CARS

The Easton Car & Construction Company announces the completion of arrangements by which The Cambrian Wagon Co., Ltd., of Cardiff, Wales, is given the right to manufacture Easton Quarry Cars.

The Cambrian Wagon Company is one of the best known builders in England of railway and industrial cars, and a continuation of the Easton policy and quality is assured.

The superiority of Easton Cars and the skill of our engineers in originating and perfecting the best in quarry cars are thus awarded world wide recognition.

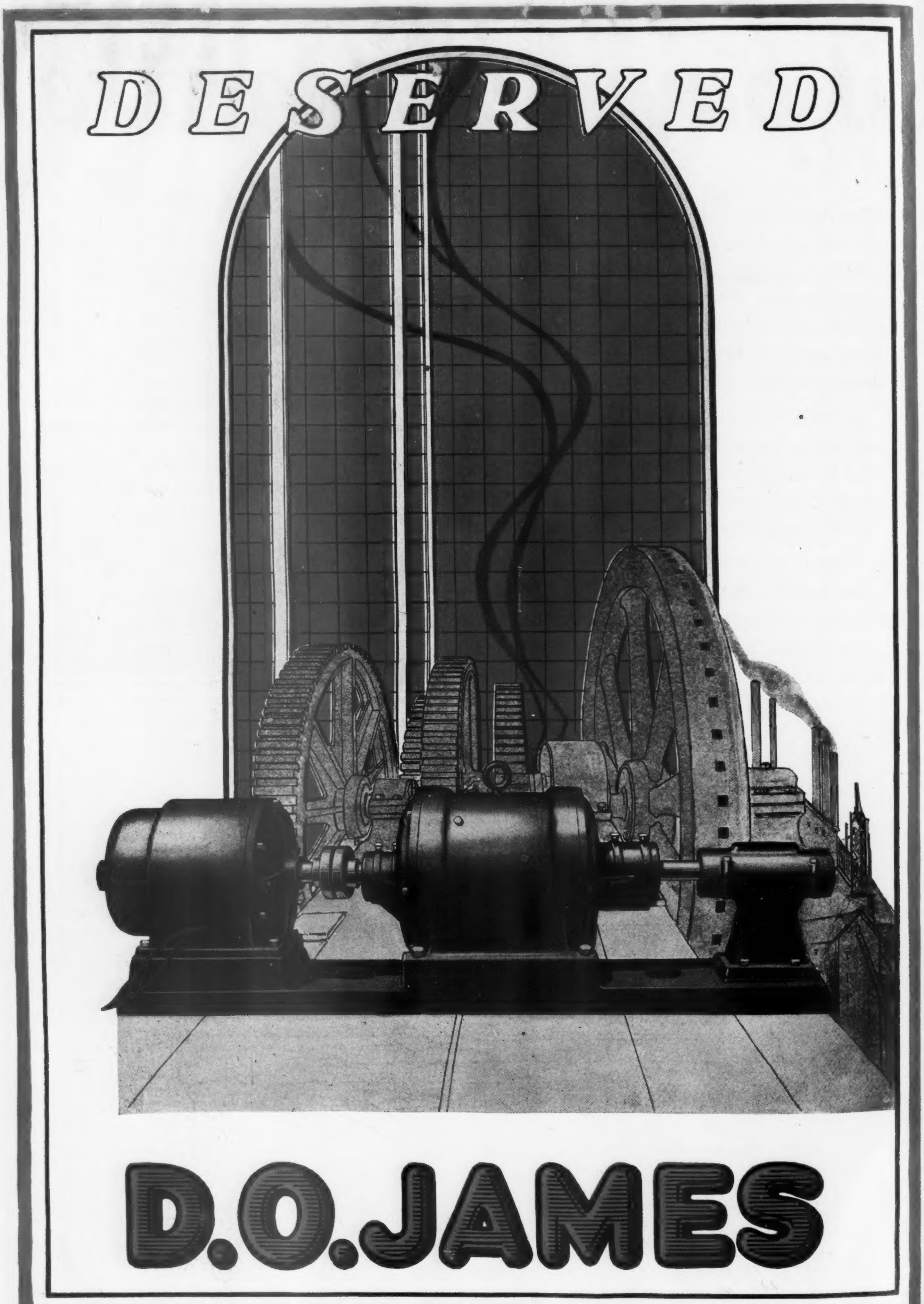
EASTON CAR & CONSTRUCTION CO.

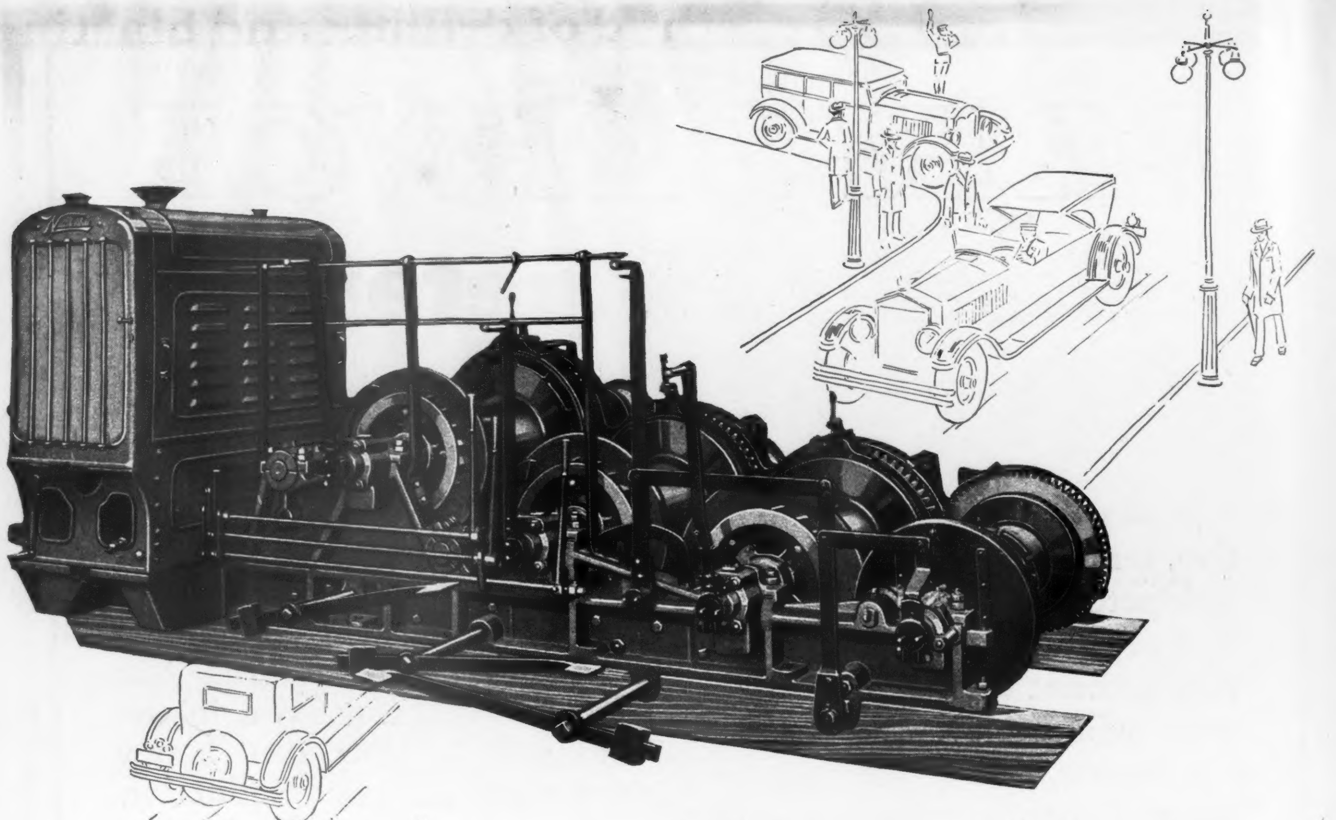
Kansas City, Mo., and Easton, Pa.

New York Chicago Pittsburgh Philadelphia San Francisco

EASTON CARS

FOR EVERY PIT MINE & QUARRY


DESERVED
D.O.JAMES



Flexible~
as the Modern Fine Car

AS THE MODERN AUTOMOBILE weaves through traffic it is almost instantly responsive to every power demand. Did you ever think the same could be said of a hoist designed for your use?

The new 60 H.P. patent Three-Speed Mundy Hoist possesses a flexibility of operation which closely approaches that of a fine automobile. Its slow speed is 180 ft. per min., with a line pull of 8,000 lbs.; intermediate speed, 290 ft. per min., with line pull of 5,000 lbs.; high speed, 435 ft. per min., with a line pull of 3,300 lbs. And a complete change of speed, and line pull ... in ten seconds!

There's a hoist for you ... a hoist that adapts itself with utmost ease to the changing "traffic conditions" of your job!

May we send you the folder describing the hoist?

MUNDY TRADE MARK ESTABLISHED 1869

To Equipment Distributors

The New Patent Three-Speed Hoist is fully protected by patents in the United States and Canada.

Some open exclusive sales territory is now available.

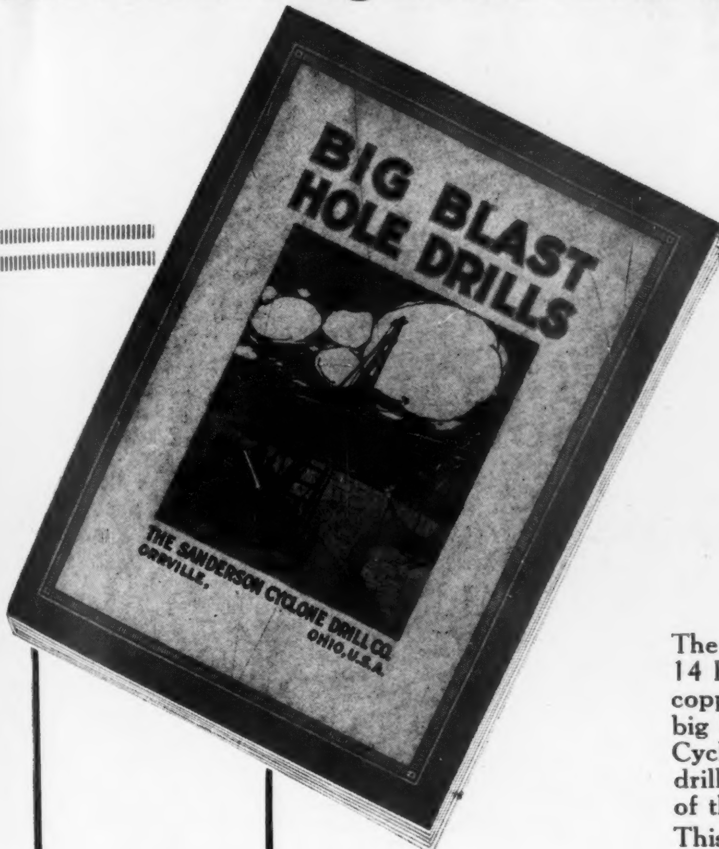
The Mundy Sales Corporation

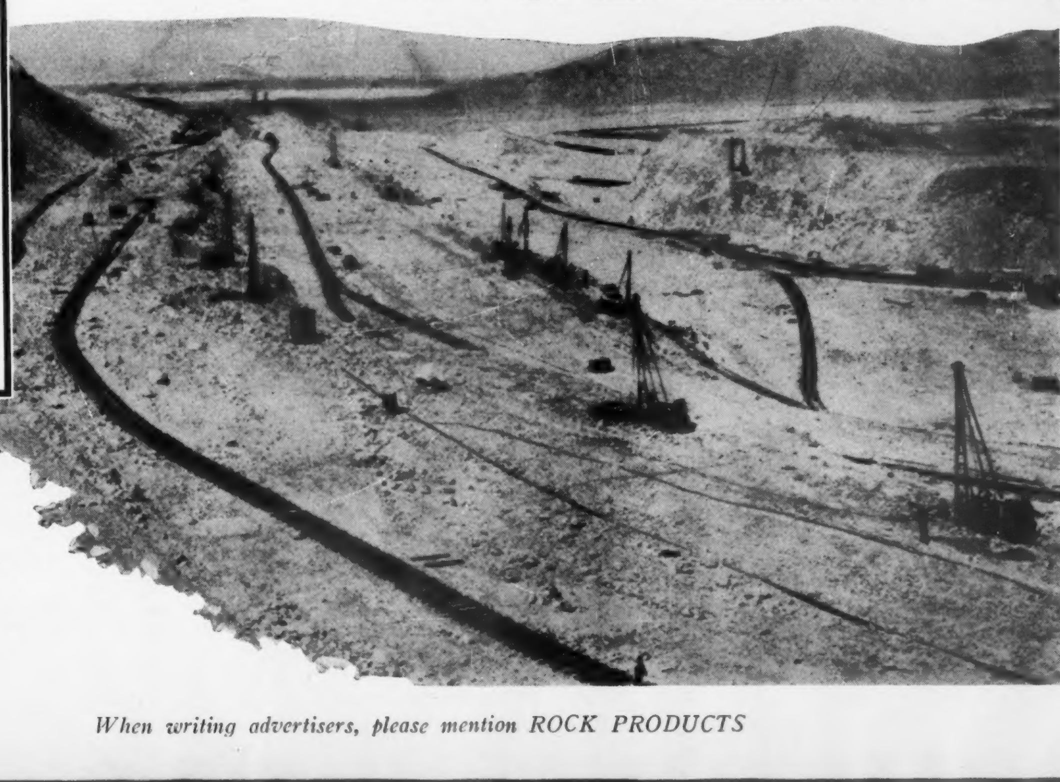
Distributors for the J. S. Mundy Hoisting Engine Co.

30 Church St., New York

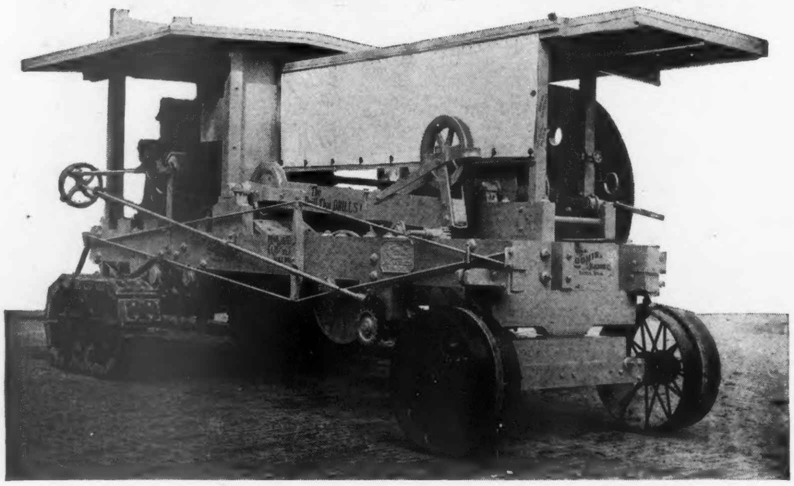
Agents in Principal Cities

MUNDY HOISTS
THE HOIST WITH THE ASBESTALL FRICTIONS


BIG BLAST
HOLE DRILLS
THE SANDERSON CYCLONE DRILL CO.
ORRVILLE,
OHIO, U.S.A.



CLIPPER



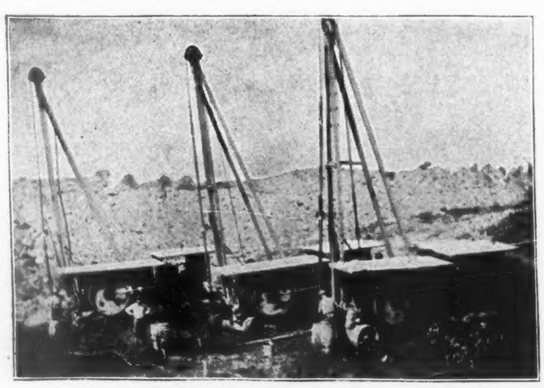
The "Loomis Clipper" has passed all tests

"The simplest and the most efficient Blast Hole Drill ever produced"—that's the unanimous verdict of users of this drill, known as the "Drill that Drills," the new-type **"Clipper."**

It has been used, under the most gruelling service conditions, by those who know and demand the maximum in efficiency, durability and economical maintenance. And nothing but the heartiest praise has attended its performance.

Users say its numerous NEW features make it the greatest drill ever produced. Those who do not know "Clipper" performance-standards will realize that no more could be said!

Let us tell you, in detail, about the new-type "Clipper." Write today.

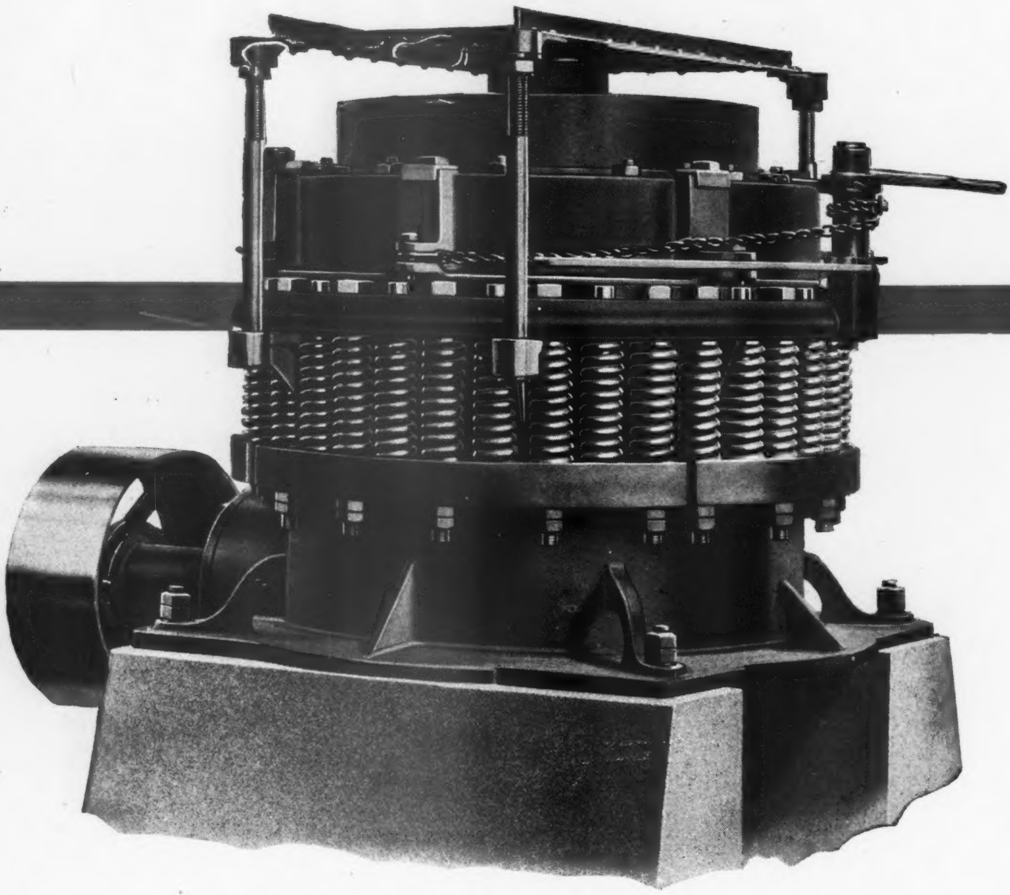


The Loomis Machine Co.

15 E Street, Tiffin, Ohio
(Established 1842)

Cable Address—SIMOOL

—a fine reduction crusher



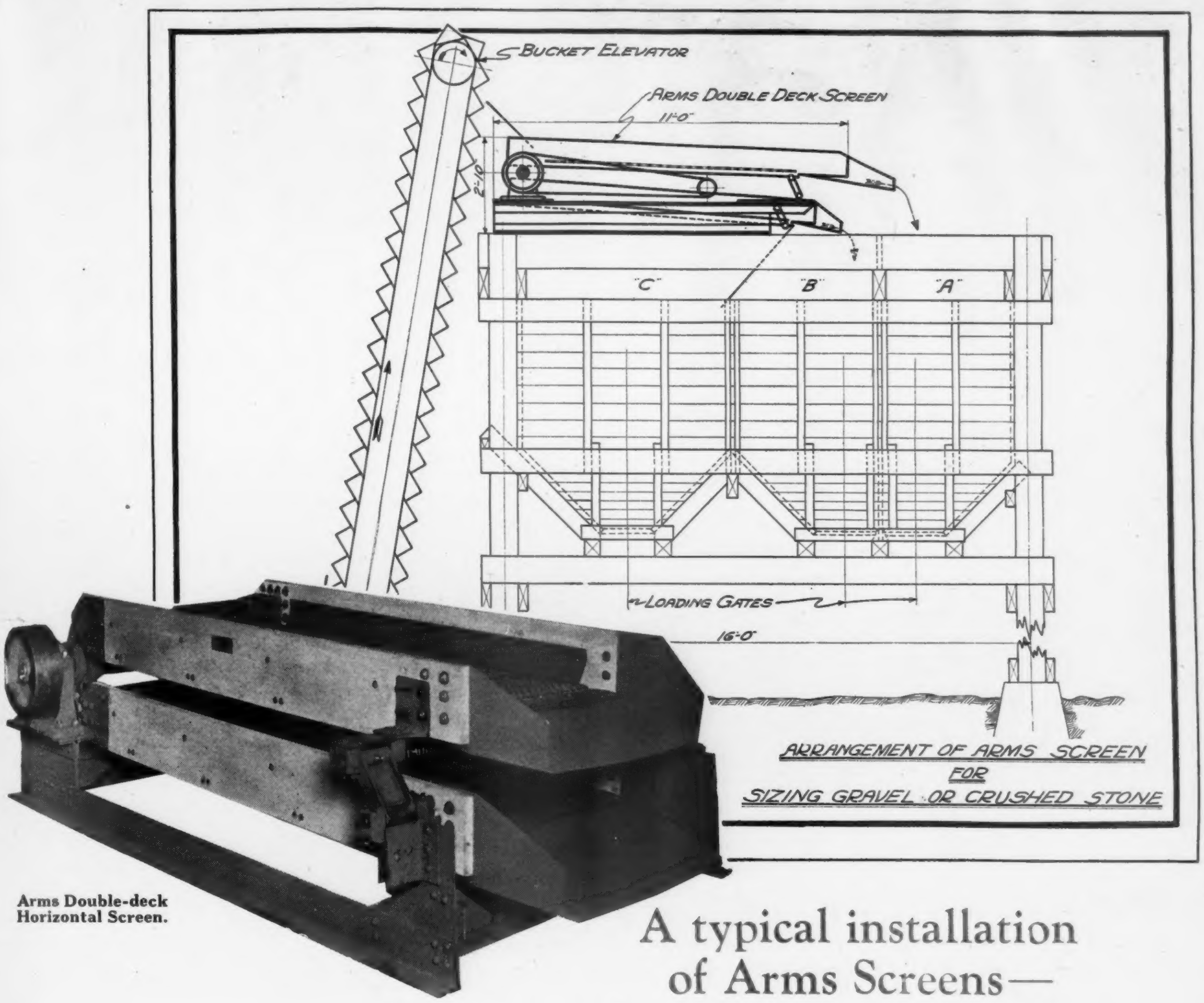
[★] *Employing an entirely different crushing principle*

The Symons Cone Crusher

- **Steel, Bronze, and Manganese construction.**
- **Spring protection against tramp iron and steel.**
- **Can be adjusted for different size product while crushing.**
- **Crushes wet or dry material.**
- **Manganese parts do not wear bell-shape or in grooves.**

— built in five sizes —

SYMONS BROTHERS COMPANY



Arms Double-deck Horizontal Screen.

A typical installation of Arms Screens— for three part separation

It shows—

The low head room required.
The flat slope of the screens—this insures accurate separation.
The typically economical arrangement—economical in construction and in operation.

It cannot show—

The hand riffle motion of the screen which—by virtue of the Arms design—cannot be dampened or checked by a sudden rush of material.
The construction which permits a quick, convenient change from one size screen to another.

You can see—

The actual, effective operation of these screens at our Testing Plant at Harvey, Illinois—equipped with full-size machines.
We will gladly show you this testing plant, or send you any information on request.

Send for Bulletin No. 87

ROBERTS AND SCHAEFER CO.

Pittsburgh, Pa.
418 Oliver Bldg.

ENGINEERS AND CONTRACTORS
CHICAGO, U.S.A.

Huntington, W. Va.
527 First St., Box 570

Manufacturers of Rotary Car Dumpers

Predominate in the Stone, Lime *and* Cement Industries

Today 7 out of 10 Quarry Installations are Marions

There are a lot of reasons for the domination of Marion equipment —and all of them may be found in the Marion nearest you. In other words, with little talking on our part and a lot of performing on the part of our shovels, quarrymen have come to find Marion and big production synonymous. We try to pioneer and we want quarry business only as long as we justly deserve it—so long as we make your problems our problems.

Think of the Marion first as the quarry shovel that will crowd your blasting crew—You'll not go wrong.

Send for your copy of the latest quarryman's book – *"Crowding the Blasting Crew"*

The Marion Steam Shovel Co.
Marion, Ohio

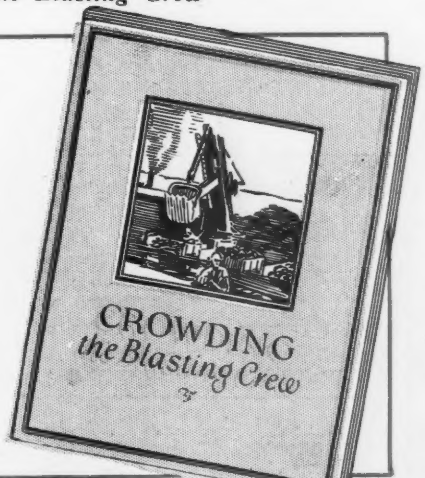
Please send me, without obligation, one copy of your bulletin No. 317, entitled "Crowding the Blasting Crew."

Name____________________

Position____________________

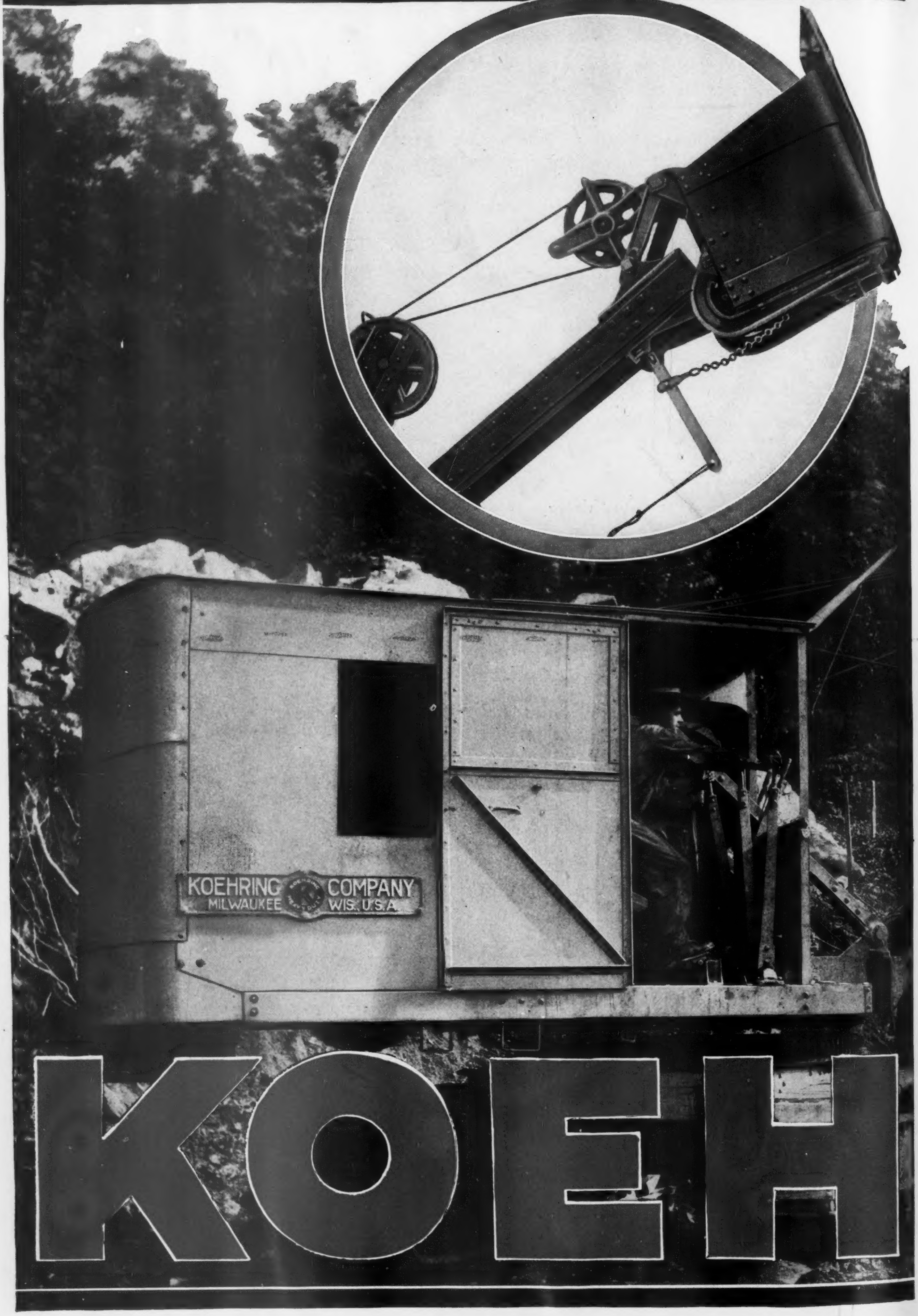
Company____________________

Company Address____________________



MARION

THE MARION STEAM SHOVEL CO. MARION OHIO U.S.A.


KOEHRING COMPANY
MILWAUKEE WIS. U.S.A.
KOEH

On Any Kind of Job!

IN gravel pit or excavation—on street or highway grading—for high bank work or shallow stripping—on any kind of job, the Koehring is instantly adaptable.

AUTOMATIC SELF-ADJUSTMENT OF CROWDING CABLES enables operator to raise or lower boom to suit operating conditions without delay for mechanical adjustments!

FINGER-TIP EASE OF LEVER CONTROL without sacrificing the "feel" of the load, enables operator to handle operation with swift accuracy and confidence that mean extra yardage every day.

CROWDS ABOVE AND BEYOND THE END OF BOOM! Independent "crowd" permits high lift with long sticks and short boom!

Strictly internal combustion engine design in every gear and detail gives a smooth responsiveness of operation that minimizes wear and promotes speed operation—and of course, Koehring Heavy Duty construction means dependability and long service life!

Know the Koehring. Send for Shovel Bulletin No. S.—29.

KOEHRING COMPANY
PAVERS, MIXERS — GASOLINE SHOVELS, CRANES AND DRAGLINES
MILWAUKEE, WISCONSIN
Sales Offices and Service Warehouses in all principal cities
Foreign Dept., Room 1370, 50 Church St., New York City
Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

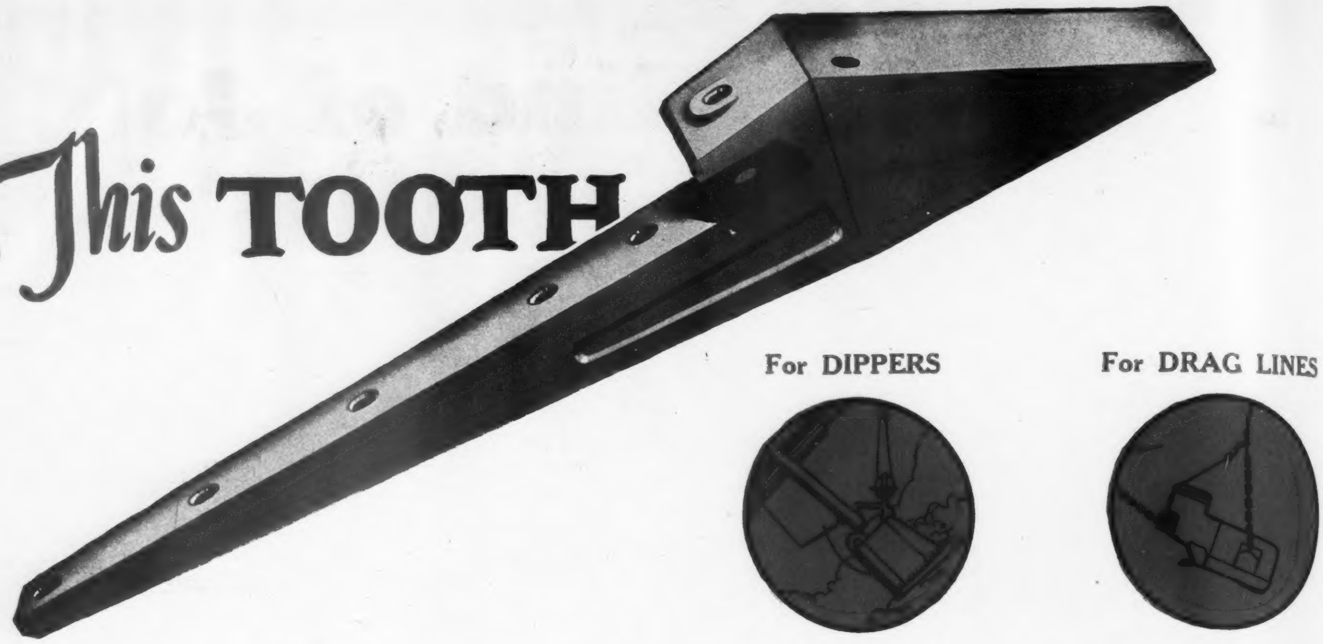
Shovel Capacities

No. 1—¾ cu. yd. dipper, struck measure, on 19 ft. 6 in. boom, with 16 ft. dipper sticks; 4 cyl. 5x6 in. gasoline engine, 1100 R. P. M.

No. 2—1⅛ cu. yd. dipper, struck measure, on 20 ft. 7 in. boom, with 16 ft. dipper sticks; 4 cyl., 6x7 in. gasoline engine, 925 R. P. M.

A3221-II

This TOOTH

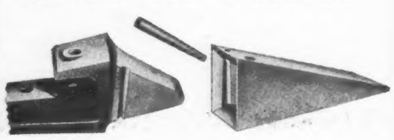


For DIPPERS

For DRAG LINES

made tougher-wears longer

Reverses Faster



The outstanding feature of Westeeco Teeth is that they can be changed or reversed faster than any other teeth. The usual delays are eliminated to a great extent through the use of Westeeco Teeth. Actual tests made have proven one man with hammer and drift pin can reverse four Westeeco Teeth on any bucket up to 2½ yards capacity in less than five minutes.

Westeeco Teeth are made of a special alloyed steel, being tougher and harder than the average teeth, possessing a tensile strength of at least three times that of ordinary cast steel. The density and toughness of the Westeeco Teeth due to the materials used in the manufacture together with the patented design assures long life.

Another known feature is that Westeeco Teeth can be forged or drawn out as easily as ordinary carbon steel.

Take time at the Chicago Road Show to drop in at Booth N. C. B. 32 and allow us to demonstrate the features of Westeeco Teeth.

Our engineers and research laboratories are at your command for cooperative service.

WESTEECO PRODUCTS

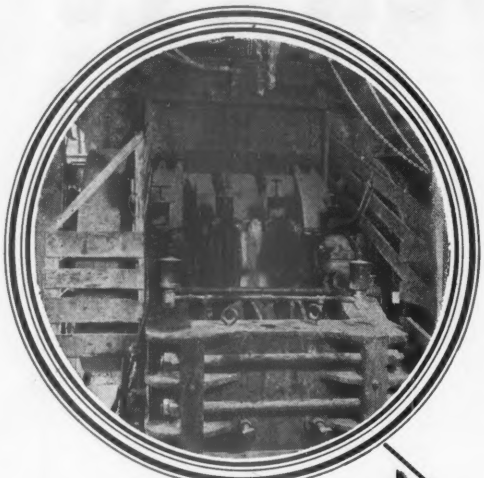
V. G. Honstain, Patent
Manufactured exclusively by
Western Crucible Steel Casting Co.
2833 Grand Ave. So. Minneapolis, Minn.

Western Crucible Steel Casting Co.

2833 Grand Avenue **Minneapolis, Minn.**

"The Dependable Crusher"

Summaries on These Pages Extracted from Ind



THE ANNVILLE STONE COMPANY
West Lebanon, Pa.

Quarry operator ran BUCHANAN crusher fifteen years.

Still in good operating condition.

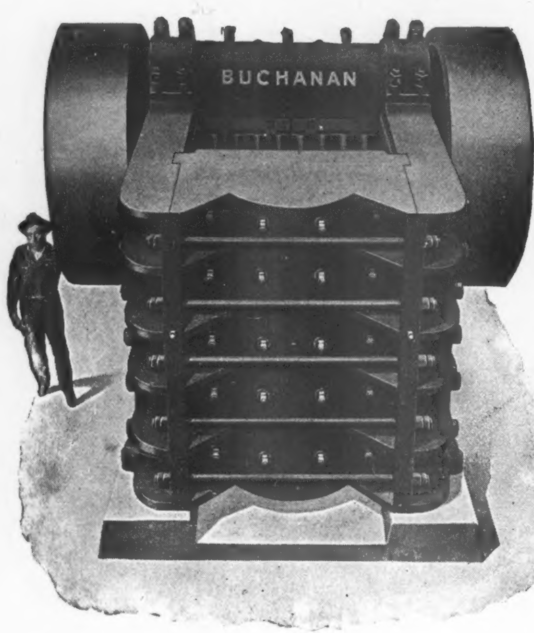
Found it dependable and low in upkeep cost.

Equipped new quarry with another of same make.

Operate all year and often at night.

It will take stone practically as large as the upper opening of the jaws—40x48 inches.

Crushing cost per ton—$.0358.



May we send you complete copies of the independent engineers' surveys, certified by the users, on these and other typical installations?

THE FEHR & O'ROURKE STONE COMPANY
Shillington, Reading, Pa.

Stone plant installed BUCHANAN 36"x48" jaw crusher.

Replaced smaller jaw crusher as primary breaker.

Has crushed at rate of 900 tons in ten hours.

With jaw setting of 5½ inches.

Stone exceptionally hard.

Has speeded up production 25%.

Saving in plant and overhead expenses is $21.25 a day.

Saving in labor is $23.65 a day.

Saving in quarry pit expense is $22.00 a day.

Additional operating cost is only $32.51.

Net daily saving is $34.39.

Annual saving is $7,565.80.

Returns 19¾% on investment.

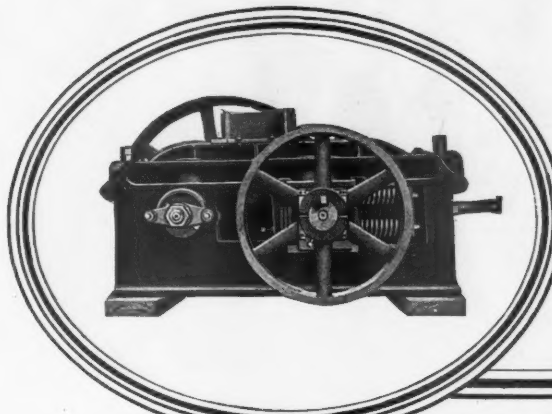
Crusher is running at only 50% of capacity.

BUCHANAN *for forty years*

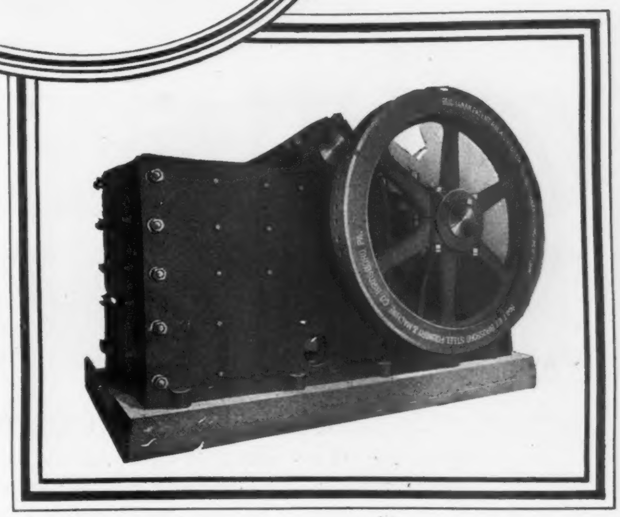
has earned these comments

ependent Engineers' Surveys, Certified by the Users

THE GOODWIN-GALLAGHER SAND & GRAVEL CORP.
Port Washington, Long Island, New York



Largest producer of sand and gravel in the world.
Output about three million cubic yards annually.
BUCHANAN roll crushers installed in 1920, 1922, and 1925.
Type "C" 42"x16" BUCHANAN roll crusher handles 400 to 500 tons of gravel in nine-hour day with 1⅛" setting.
Power consumption with average production of fifty tons per hour, 16.14 kw.
Crushing cost $.0361 per ton, $.0488 per cubic yard.
Repair cost low.
None of phosphor bronze bearings renewed.
Clay does not clog up roll crusher.
BUCHANAN crusher has proved reliable.



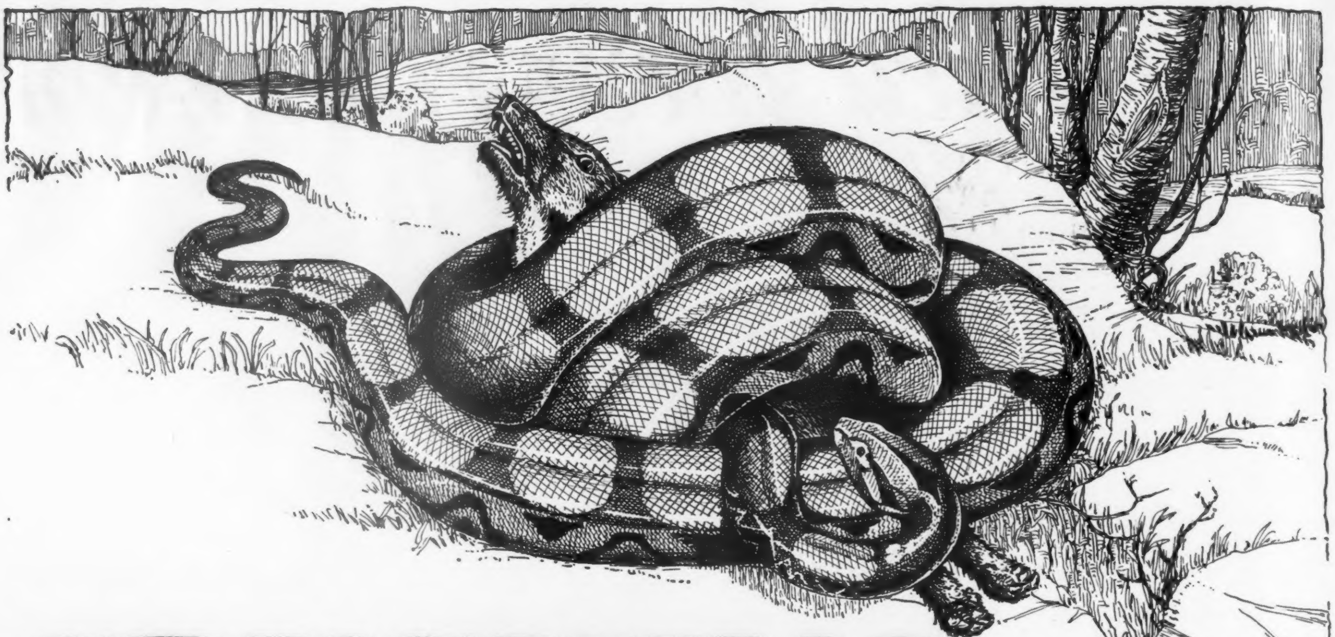
THE NEW HAVEN TRAP ROCK COMPANY
North Branford, Connecticut

Trap rock producer chose BUCHANAN Type "C" jaw crusher.
Used for primary breaking.
Dependability was first consideration.
In service eleven years.
Has not lost a day for repairs.
Takes rock up to 43"x67".
Reduces to 8½-9½ inch.
Crushing strength of rock averages 49,400 lbs. per square inch (U. S. Government Test from Washington, D. C.).
Power input to crusher averages 108 HP.
Production averages 4,000 tons in ten hours.
Cost per ton is $.0074.

BUCHANAN users, without exception, swear by the dependability and low upkeep cost of BUCHANAN crushers. Let us send you bulletins.

C. G. BUCHANAN COMPANY, Inc.
93 West St., New York

builders of better **CRUSHERS**



CRUSHING POWER

Cruel and merciless in its tactics, the Boa Constrictor goes about its work of destruction without hesitancy or uncertainty. The terrific crushing power with which it destroys its victims has been developed to such a degree that once it has coiled its body around that of its prey, there is no escape.

This same power has been built into Austin Gyratory Crushers. Designed for crushing the very hardest of rock, they tackle the most difficult work with the same assurance of success that characterizes the attack of the Boa.

Oversized parts where the strain is greatest, automatic lubrication, extremely large eccentrics and eccentric bearings are a few of the features responsible for the remarkable efficiency of these crushers.

The advice and assistance of expert engineers, with many years of experience in designing and constructing crushing plants, constitutes an important part of Austin service. If you can use this service, drop us a line and we will see that your problem receives our very best attention.

A special catalog describes Austin Gyratory Crushers in detail, and shows how Austin engineers have combined strength, durability, and capacity in their construction.

Write for your copy today

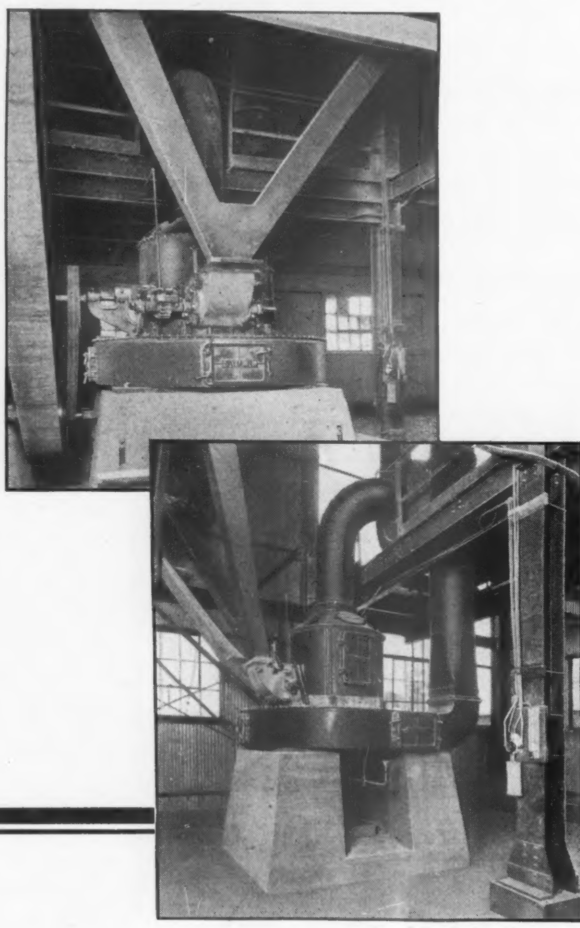
AUSTIN MANUFACTURING CO.

ESTABLISHED 1858

ALWAYS

of experienced and progressive operators

Two views of the Improved No. 5 Roller low-side Raymond Mill, equipped with heavy rolls, wide-faced bull-ring, automatic feed control, improved vacuum air separator, exhaust fan and cyclone dust collector, National Gypsum Co., new plant at Clarence, N. Y.



The leaders in every field, throughout the rock products industry, recognize the supremacy of the Raymond Mill as a fine grinding unit.

Notable 1926 examples of this preference are the two installations featured here.

The National Gypsum Company has recently put into operation, at Clarence, N. Y., what is undoubtedly one of the world's finest wallboard plants. Here the Raymond Mill was "the leader's choice."

In a newer branch of the rock products field, the calcining of crude magnesite, the Spokane Magnesite Company—the leader and pioneer—has chosen the Raymond Mill.

Since 1887, Raymond Mills have held, and deserved, this preference.

THE RAYMOND

New York City
342 Madison Ave.

Chicag
1315

THE CHOICE

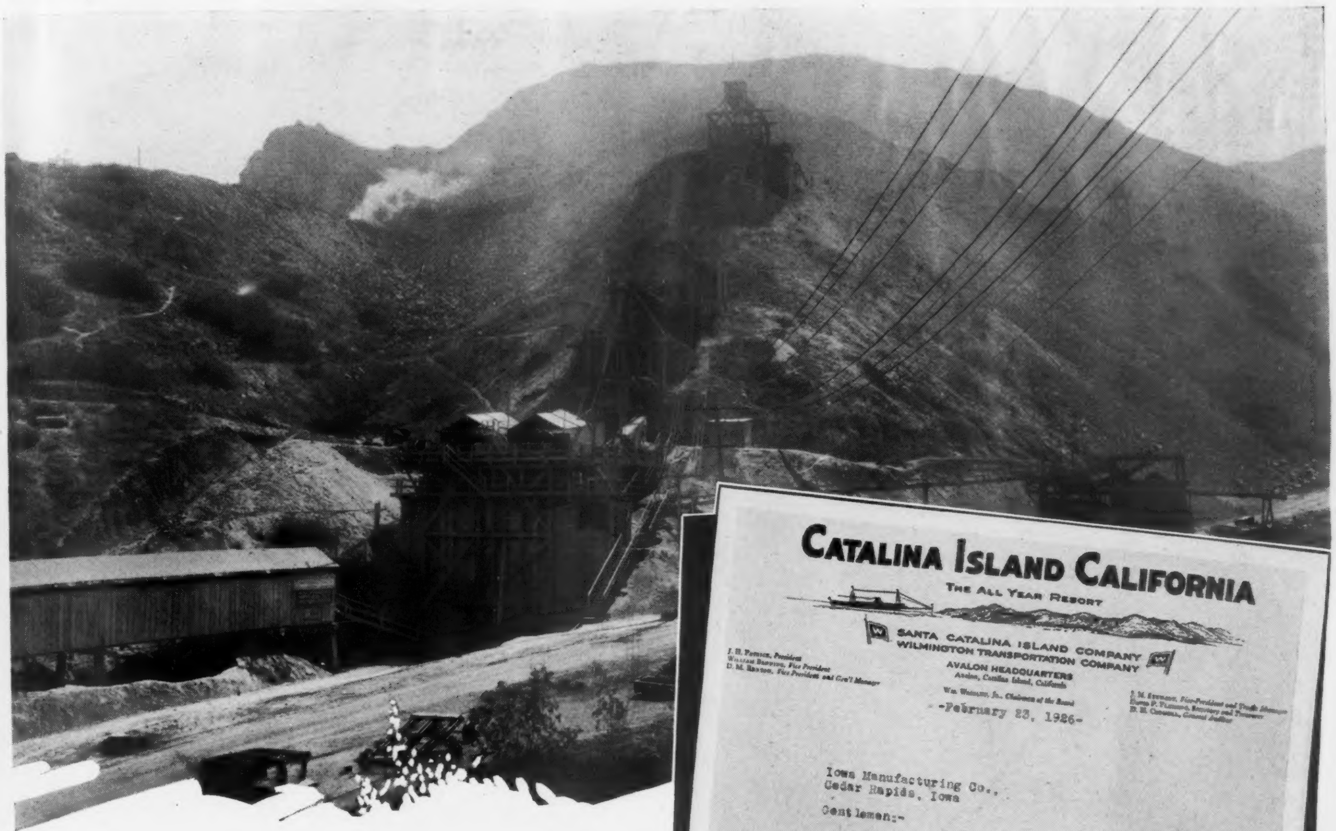
Raymond Roller Mill at the plant of the Spokane Magnesite Co., Spokane, Wash. This plant was recently built for the calcining of crude magnesite, a new process which results in plastic magnesite (a flooring and stucco material).

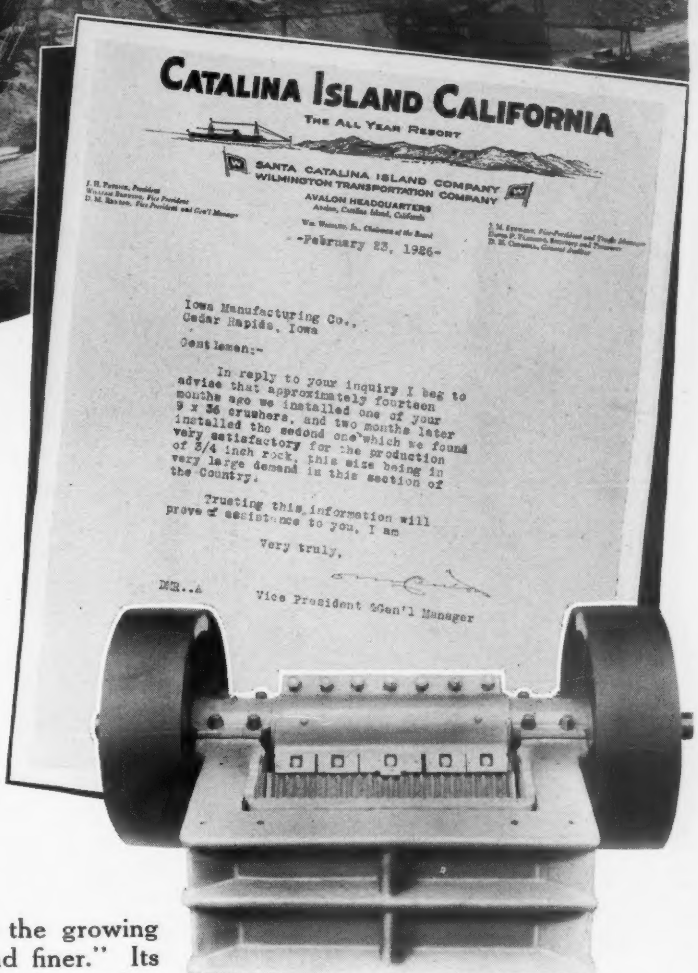
Because of the novelty of the process, much special equipment was necessitated. But when it came to the grinding stage, nothing was found to surpass the Raymond Pulverizer, always the choice of the experienced and progressive producer.

BROS. IMPACT PULVERIZER CO.

llinois
Branch St.

Los Angeles
Cotton Exchange Bldg.





CATALINA ISLAND CALIFORNIA
THE ALL YEAR RESORT
SANTA CATALINA ISLAND COMPANY
WILMINGTON TRANSPORTATION COMPANY
AVALON HEADQUARTERS
Avalon, Catalina Island, California

-February 23, 1926-

Iowa Manufacturing Co.,
Cedar Rapids, Iowa

Gentlemen:-

In reply to your inquiry I beg to advise that approximately fourteen months ago we installed one of your 9 x 36 crushers, and two months later installed the second one which we found very satisfactory for the production of 3/4 inch rock, this size being in very large demand in this section of the Country.

Trusting this information will prove of assistance to you, I am

Very truly,

DMR..A

Vice President &Gen'l Manager

Catalina Island again Installs

CEDAR RAPIDS CRUSHERS

"VERY SATISFACTORY for the production of ¾-INCH ROCK," as Catalina Island says, tells the whole story about Cedar Rapids Crushers. You, too, will be "very satisfied" with the performance of our Crushers.

The Cedar Rapids Crusher successfully fulfills the growing list of specifications that call for stone "1 inch and finer." Its mechanical action makes it the only type crusher on the market that will produce uniform stone to size ¾-inch.

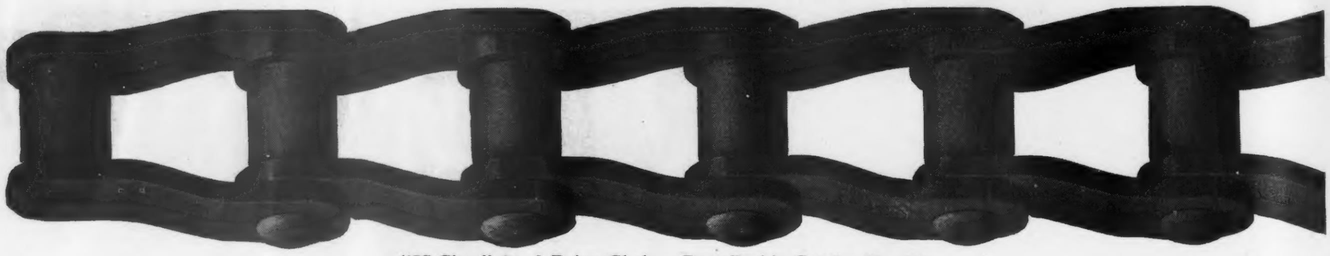
This fact explains why the Cedar Rapids is the most desired Secondary Crusher on the market. Adjustment to any size crushed stone can be made almost instantly—it is not even necessary to stop the crusher to make the change.

Write to us today for full details of the Cedar Rapids Crusher, without obligation, of course.

IOWA MANUFACTURING CO., CEDAR RAPIDS, IA.

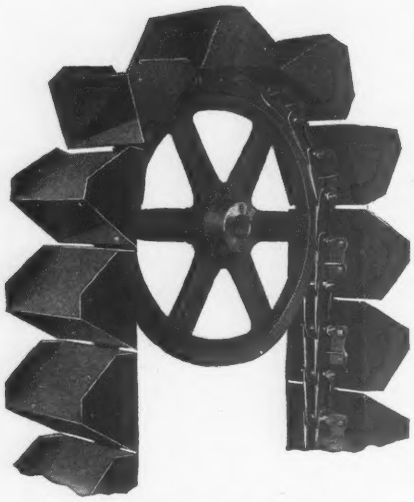
MANUFACTURERS OF

CEDAR RAPIDS CRUSHERS



"SS-Class" Steel Drive Chain. Described in Catalog No. 400.

For Material Handling, The Link-Belt

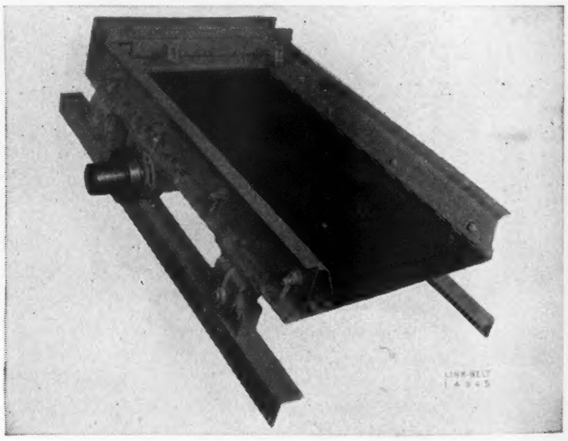


Continuous Steel Buckets; also made overlapping. Complete data in Catalog No. 400.

>FLINT-RIM< Sprocket Wheels are made by special process, perfected by us after many years of investigation and experience. They give a hard, smooth bearing surface, free from sand. Complete information in Catalog No. 400.

HAVING such facilities as only the leading manufacturer of elevating, conveying and power transmission chains and machinery would have—and maintaining large stocks at all times, Link-Belt is in a position to give you unusually prompt service. Branch offices, in charge of

Link-Belt >HEX-TOP< Compression Grease Cups are made of malleable iron instead of steel, because years of service have proved that malleable iron will stand up better. The >HEX-TOP< makes it a real "Safety-First" Grease Cup.



The Link-Belt Vibrating Screen is especially effective in the exact and careful screening of such materials as cement, clay, gypsum, lime, crushed rock, sand, gravel, etc. A new book No. 862 is now available.

The Link-Belt "Built for Service" Crawler for contracting and industrial uses, are increasing in favor because of exclusive features that mean speed, operating convenience and reliability. Ask for Book No. 895.

LINK-BELT

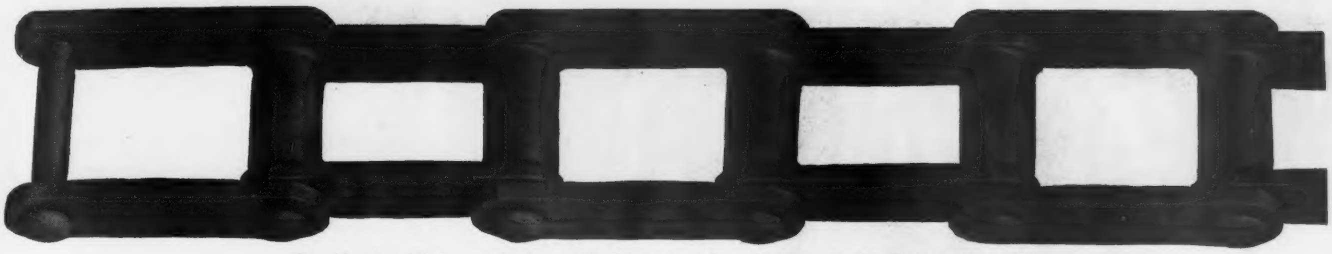
Leading Manufacturers of Elevating, Conveying,

CHICAGO, 300 W. Pershing Road INDIANAPOLIS,

Atlanta	511 Haas-Howell Bldg.	Cleveland	527 Rockefeller Bldg.
Birmingham, Ala.	720 Brown-Marx Bldg.	Denver	520 Boston Bldg.
Boston	49 Federal St.	Detroit	5938 Linsdale Ave.
Buffalo	554 Ellicott Square	Huntington, W. Va.	Robson-Prichard Bldg.

H. W. CALDWELL & SON CO.:—Chicago, 1700 S. Western Ave.;
LINK-BELT MEESE & GOTTFRIED CO.:—San Francisco, 19th and Harrison Sts.;
Portland, Ore., 67 Front St.

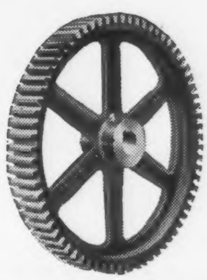
LINK-



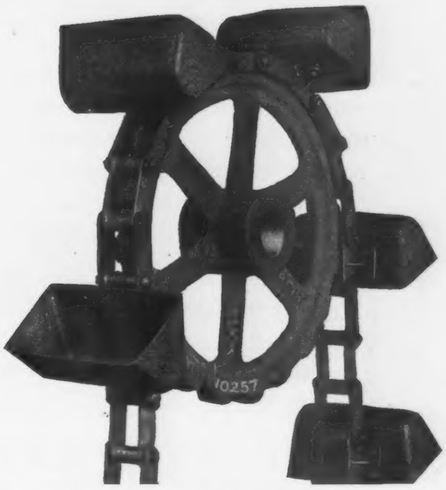
Combination Chain, combining malleable iron and steel. Described in Catalog No. 400.

and Power Transmission Line is Complete

competent engineers, are located conveniently, so that you may draw upon the knowledge and experience of many years' service to industry. On this page you will find a few of the many products built by Link-Belt; special catalogs on each are available. Write our nearest office.



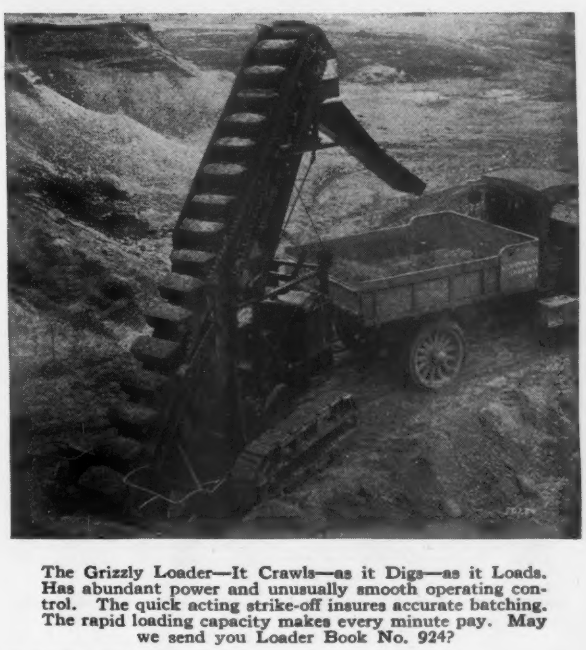
Gears made by Link-Belt are smooth running, correct in design, accurate and true to pitch. We make all types—machine-moulded, cut tooth, mortise gears, etc. Complete list in Catalog No. 400.



Our line of malleable iron buckets is complete. Each represents the best in design, workmanship and material quality. Large stocks on hand. Complete information in Catalog No. 400.

Link-Belt Malleable Iron Safety Collars combine correctness of design with great strength, toughness, durability and light weight. The design is simple, convenient and practical. Special folder upon request.

Today no one questions the value of the Portable Loader for low cost handling of materials. There can be no comparison between the Portable Loader and hand shovelers—in cost or capacity—so superior is the machine to labor. Ask for Book No. 878 for full description.



The Grizzly Loader—It Crawls—as it Digs—as it Loads. Has abundant power and unusually smooth operating control. The quick acting strike-off insures accurate batching. The rapid loading capacity makes every minute pay. May we send you Loader Book No. 924?

COMPANY 2913

and Power Transmission Chains and Machinery

200 S. Belmont Ave. PHILADELPHIA, 2045 Hunting Park Ave.

Kansas City, Mo., R.436, 1002 Baltimore Ave. Pittsburgh - - - - - - 335 Fifth Ave.
Louisville, Ky. - - - - - 397 Starks Bldg. St. Louis - - - - - - - 3638 Olive St.
New Orleans - 504 New Orleans Bank Bldg. Toronto 2, and Montreal, Link-Belt Limited
New York - - - - 2676 Woolworth Bldg. Wilkes-Barre - 826 Second Nat'l Bank Bldg.

Dallas, Texas, 810 Main St.; New York, 2676 Woolworth Bldg.

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-BELT

The Speed Machine of the Hour

Ready to "hop-to-it" the moment the operator puts his foot in the cab, the Moore Speedcrane is prepared to deliver a faster day's performance than you ever have imagined possible.

Its patented gear shift permits the use of one reversible clutch that does the work of three on other cranes—swinging the crane, propelling the machine and raising and lowering the boom. This simplified control means not only easier operation but speedier performance—a factor of prime importance when early completion of a job is desired.

Simplicity of construction, without loss of strength to its parts, gives the Moore Speedcrane an endurance factor that means a long life of usefulness—which, with its speedy performance, is a real reason why Speedcrane users are ***satisfied*** users.

Let us demonstrate to you Speedcrane speed and endurance. See our nearest distributor or write us direct, today.

MOORE SPEEDCRANE COMPANY

38 So. La Salle St. Chicago, Illinois

The Satisfied Speedcrane User Says:

"It is a pleasure for us to advise you of our satisfaction with our SPEEDCRANES and to express our appreciation of our experience with them. All of our operators are old, experienced men and they claim, without exception, that the SPEEDCRANE is the best constructed, most easily operated, and most speedy crane they have ever operated."

JOSEPH HOCK, Pres.,
Wisconsin Lime & Cement Co.
(Owners of 13 Speedcranes)

"I bought our first SPEEDCRANE on the inspection report of our mechanical superintendent, Mr. Jennings. After a thorough test I purchased another. Since that time I have purchased six more SPEEDCRANES to replace other makes. I consider the SPEEDCRANE the most efficient yard equipment that I have ever used for unloading cars, storing material and for loading trucks."

J. W. ALDER, Pres.
American Sand & Gravel Co.
(Owners of 8 Speedcranes)

"I will say that at present I own and operate several makes of steam shovels and cranes and, without question, if I wanted another crane, I would order another SPEEDCRANE. I think an easy way for any engineer to pass an opinion on the merits of this machine would be to come and see mine. These machines have handled from 100,000 to 150,000 cubic yards each and the machine does not look as if it has been from the shop thirty days—no expense except minor stuff, such as brake band. The machine is practical from every standpoint."

H. BAIRSTOW
Chicago Contractor
(Owner of 2 Speedcranes)

MOORE

SPEEDCRANE

ASBESGRAPHITE
Is Self-Lubricating

Self-lubricating frictions are a necessity in this day of heavy duty machines and high speed production. Asbesgraphite molded brake and friction blocks are self-lubricated to prevent wear and to keep the friction surfaces in smooth condition. They eliminate grabbing, sticking or jerking, and assure a smooth, cushion-like, positive grip that holds tenaciously.

The exclusive lubricating features of Asbesgraphite help materially in withstanding the most severe service, besides greatly increasing operating efficiency. It is unaffected by oil, dirt, water, heat or cold. Asbesgraphite is molded to machined perfection in any shape or size to fit any clutch or brake.

We will gladly cooperage with you in an investigation of Asbesgraphite

We mold blocks for brake and friction bands in all sizes, for power and electric shovels, dredges, draglines, excavators and hoists.

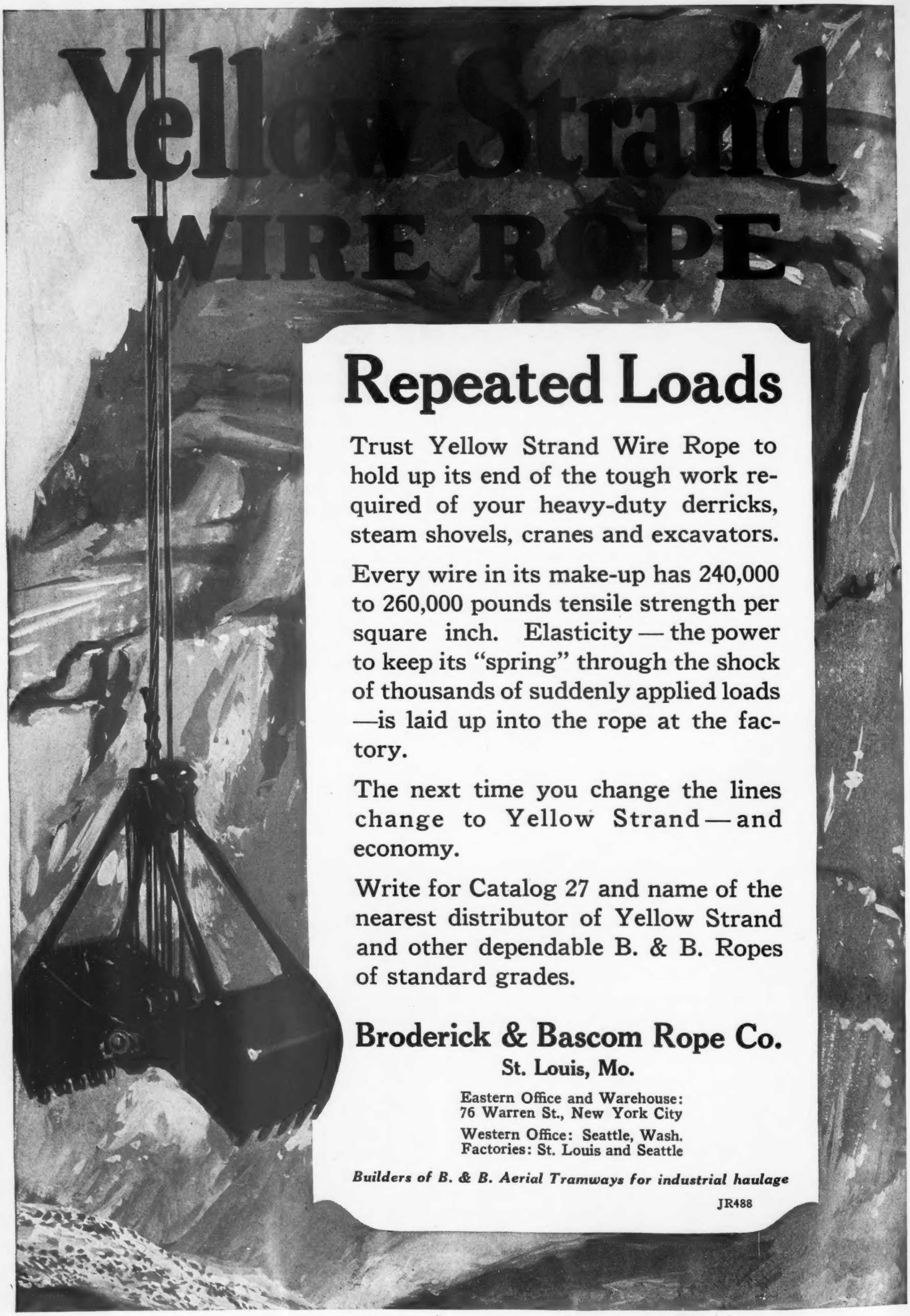
"Ektag," the Gatke Folded and Compressed Asbestos Brake Lining, is carried in stock for immediate shipment.

THOMAS L. GATKE

Chicago Office
516 Railway Exchange Bldg

Factory
Winona Lake, Ind.

ASBESGRAPHITE
ASBESTOS GATKE COMPOSITION


Yellow Strand
WIRE ROPE
Repeated Loads
Trust Yellow Strand Wire Rope to hold up its end of the tough work required of your heavy-duty derricks, steam shovels, cranes and excavators.
Every wire in its make-up has 240,000 to 260,000 pounds tensile strength per square inch. Elasticity — the power to keep its "spring" through the shock of thousands of suddenly applied loads —is laid up into the rope at the factory.
The next time you change the lines change to Yellow Strand — and economy.
Write for Catalog 27 and name of the nearest distributor of Yellow Strand and other dependable B. & B. Ropes of standard grades.
Broderick & Bascom Rope Co.
St. Louis, Mo.
Eastern Office and Warehouse: 76 Warren St., New York City
Western Office: Seattle, Wash.
Factories: St. Louis and Seattle
Builders of B. & B. Aerial Tramways for industrial haulage
JR488

How to make a GOOD SHOT by using CORDEAU-BICKFORD

Fig. 1

In order to make a good shot it is necessary that the entire charge be detonated instantaneously. This can be easily and safely accomplished by the use of Cordeau-Bickford detonating fuse which has an average speed of about 17,500 feet per second and will set off the largest blast with undiminished effectiveness thruout its entire length.

When using this fuse, careful observance of the following simple rules will assure the blaster of satisfactory results with every shot.

Cut back several inches from the end of the Cordeau at the top of the drill hole. Slit the Cordeau about four inches with the Cordeau slitter (Fig. 1). *Never use a knife for connections—it will not slit properly and evenly.*

Lay back sides almost at *right angles* from the unslit portion (Fig. 2).

Seat the main line *snugly* and *firmly* against the exposed T.N.T. in the base of the fork (Fig. 3).

Wind the slit portions *tightly* four or five times around the main line (Fig. 4 and 5).

Never use makeshift methods. When in doubt, write us.

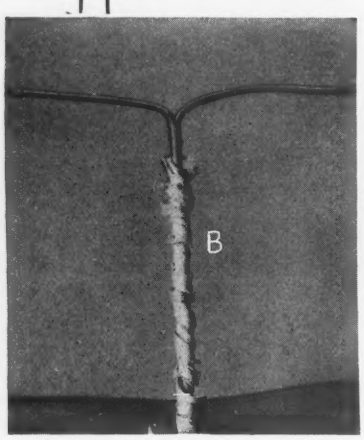


Fig. 2

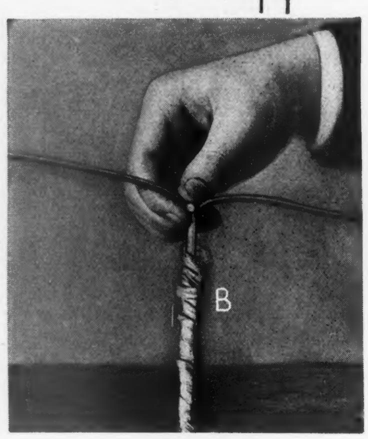


Fig. 3

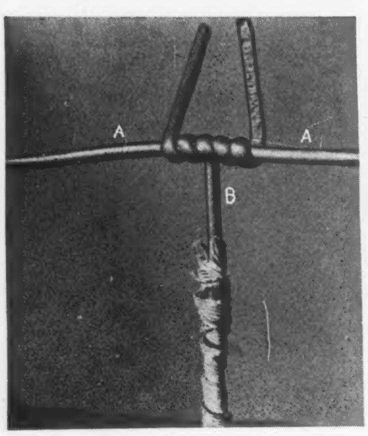


Fig. 4

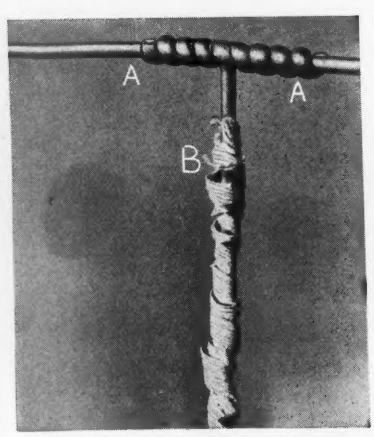


Fig. 5

CORDEAU-
DETONATING FUSE
BICKFORD

THE ENSIGN-BICKFORD COMPANY

SIMSBURY, CONN. ESTABLISHED 1836

X-71 Hammer Drills on Tripods putting in 26-ft. horizontal snake holes

Machines That Will

THE advantages of compressed air and compressed air machinery in the quarry are being emphasized more each year. Statistics show that the industry is going more and more to air-operated machines, and the annual output has shown corresponding increases each year.

Modern air-operated machinery has not only made the *increased production* possible, but has *decreased costs.*

It is very easy to understand the yearly increase when it is known that one of the present-day hammer drills has in almost every instance replaced and done the work of three of the large piston drills.

Probably the most important step in the progress of the crushed stone industry has been the perfection and introduction of the wagon mounting for the hammer drill. This has answered the universal demand of quarrymen for a mounted drill that could be more easily moved about—one that would be more efficient than the older type, while requiring fewer changes of steel.

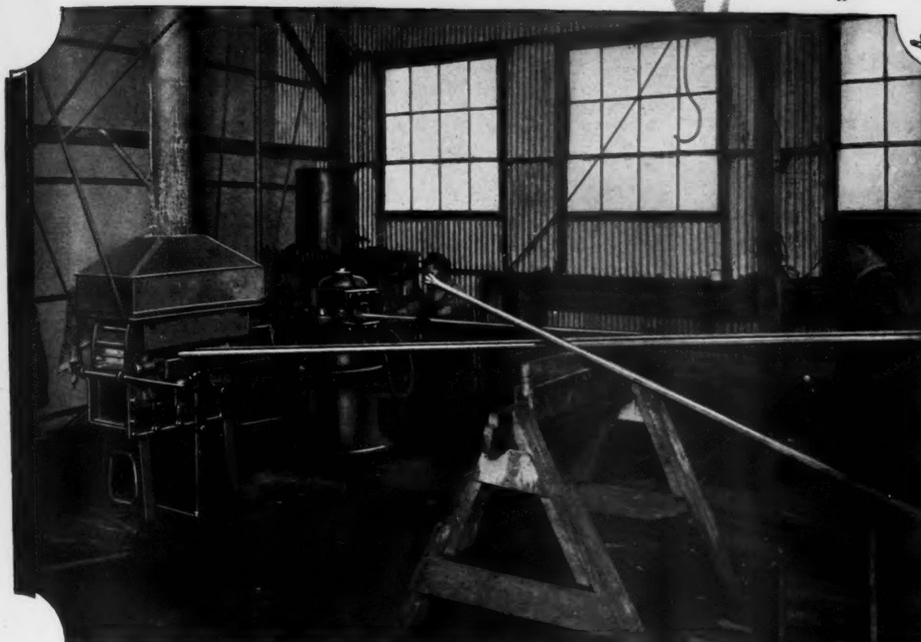
Performance Records

Each of the numerous wagon drills in operation is giving an excellent account of itself. 200 to 300 feet of hole per shift is just an ordinary run. We have records on file showing that a single drill has done 310 feet in five hours' over-all drilling time.

"Jackhamer" Drills preparing boulders for "pop-holing."

X-71 Drill working on a bench.

X-71 Hammer Drill



Steels made on the "Leyner" Sharpener increase the drilling speed

ll Make Money for You

Other labor-aiding machines which have helped to increase production and decrease costs are:

1. *"Jackhamer" Drills.* In quarries where Well Drills or other deep-hole drills are applicable, and where secondary drilling is necessary because of the large size of the rock resulting from the "big" blast, the "Jackhamer" type of drill is ideal. With these lightweight drills, shallow holes are easily and quickly drilled, and "pop-holing" is done in place of the old mud-capping system of breaking boulders. "Pop-holing" is sure, safe, and economical, and requires only a fraction of the powder used in mud-capping.

2. *The "Leyner" Sharpener for the care of your drill steel.* This machine makes perfect bits and shanks of uniform gauge. Sharpener-made steels increase your drilling speed about 35%, and reduce expensive delays due to lack of sharp steels. They also reduce the breakage of your drills and drill steel.

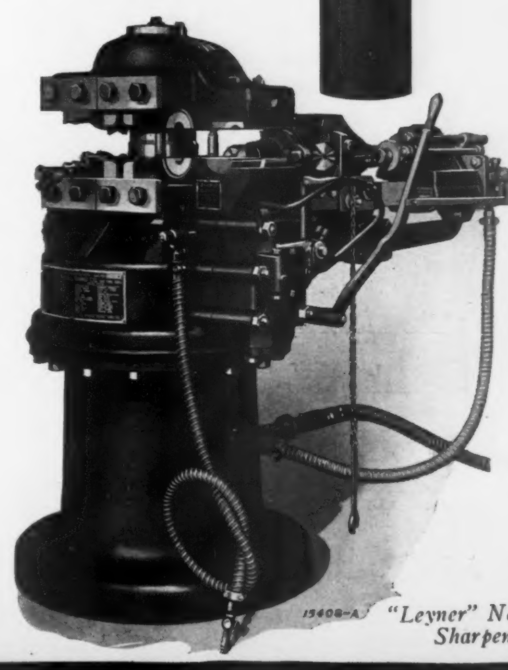
3. *The oil furnace for heating the steels.* This device, which eliminates the smoke, soot, and ash nuisances, gives a clean, uniform heat which is directly under the control of the operator. The steel cannot absorb impurities, nor can it be harmed because of decarbonization and burning.

4. *I-R Swedish Drill Steel.* Made from the purest ore, this steel is uniform in quality, easy to work, and exceptionally durable. Moreover, it takes a very hard temper.

Ingersoll-Rand Engineers

Our engineers are acquainted with quarrying conditions and rock drilling problems all over the world. They will be glad to assist you. Submit your problems to the nearest I-R branch office (See next page) or to the main office at 11 Broadway, New York.

A plentiful supply of drill steel is very important.



15408-A *"Leyner" No. 50 Sharpener*

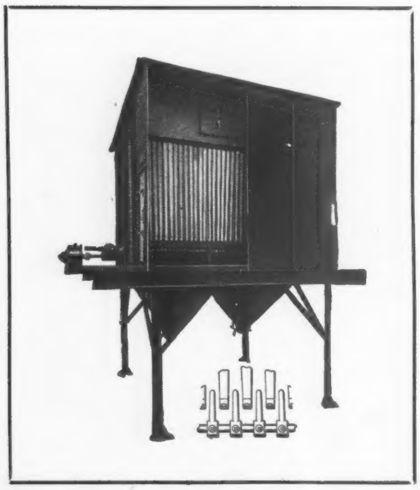
R-1331

Paxson Cloth Screen Dust Collector in plant of Lawrence Portland Cement Co.

Catching Dust and Dollars!

Collecting cement dust that clogs machinery, hampers production, affects health, not only helps toward better and more economical production but actually provides profits heretofore lost! In fact, a Paxson Cloth Screen Dust Collector really pays for itself in a short time.

Above is illustrated a Paxson Dust Collecting System in the Lawrence Portland Cement Co. In both the old and new pack houses at the Lawrence Co. plant you'll find Paxson Cloth Screen Dust Collectors working efficiently and savingly every day.



More and more is the cement industry coming to a realization of the money saving, health saving, production increasing effectiveness of Paxson Dust Collectors.

Have you considered the advantages in savings and increased profits resulting from the installation of Paxson Cloth Screen Dust Collectors in *your* plant?

J. W. Paxson Co.

Luzerne and D Streets, Philadelphia, Pa.

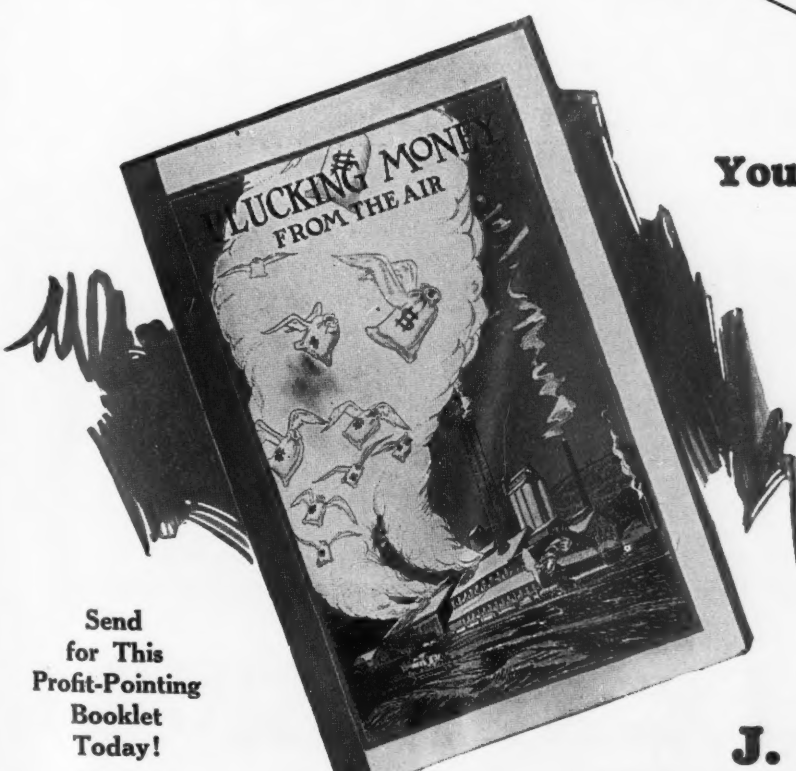
PAXSON CLOTH SCREEN DUST COLLECTORS

Plucking Money From The Air!

Money, heretofore scattered over adjoining neighborhoods; into cracks and crevices and machinery, in the shape of wasted and lost cement dust, is being returned to modern cement plants in the form of big dividends through the use of Paxson Cloth Screen Dust Collectors.

Dust is an unnecessary and wasteful practice. Why tolerate it when it can be definitely abolished? Eliminate dust and have cleaner operating conditions, prolong the life of your machinery and equipment and allow it to work with greater efficiency. Paxson Cloth Screen Dust Collectors will do away with the dust nuisance and actually make money for you.

Another prominent Pennsylvania cement plant profits with Paxson Cloth Screen Dust Collectors



Send for This Profit-Pointing Booklet Today!

Your Free Copy Is Now Ready!

Let us tell you what Paxson Dust Collectors are accomplishing for well known cement plants. You, too, can profit with this modern, sturdy dust collector.

Send today for your copy of the interesting, illustrated booklet, "Plucking Money from the Air." Your copy is waiting for you and will be sent gladly, without obligation, of course.

J. W. Paxson Co.

Luzerne and D Streets, Philadelphia, Pa.

PAXSON CLOTH SCREEN DUST COLLECTORS

ESTABLISHED 1839
CHEMICALS
ZINC
GRASSELLI
EXPLOSIVES
DYESTUFFS

Since 1839, when prairie schooners wended their way across untracked prairies, Grasselli was making the basic chemicals used in explosives.

It is only natural that with all the knowledge and experience gained through the years that the Grasselli Trade-Mark stands for the highest quality explosive producible.

With branches and warehouses everywhere, it is possible to render an invaluable service to the users of Grasselli Explosives. May we interest you?

The Grasselli Powder Company

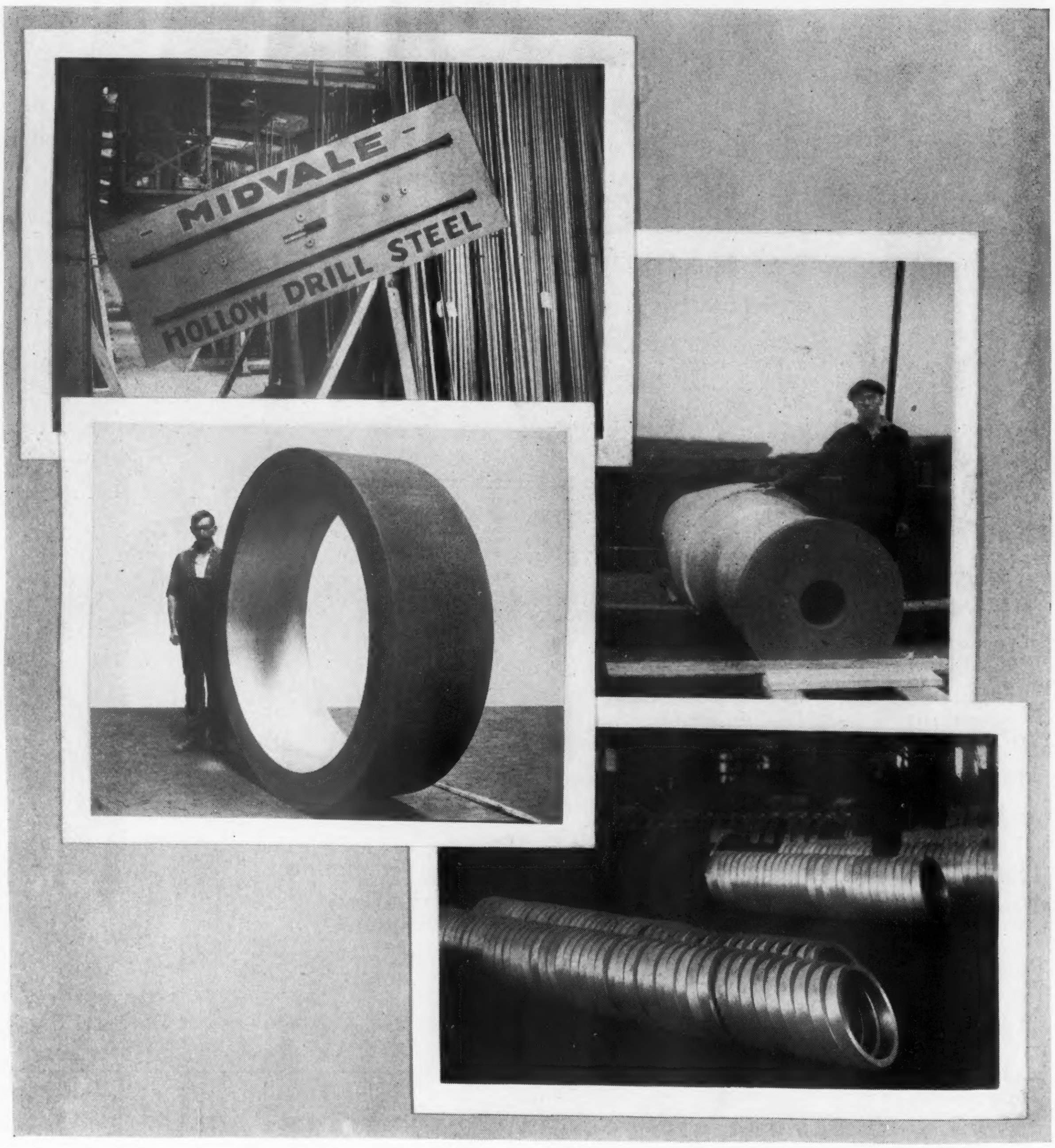
Main Office: Cleveland, Ohio

Branches:
Philadelphia, Pa.
Chicago, Ill.
Knoxville, Pa.
Bluefield, W. Va.

ESTABLISHED 1839
CHEMICALS
ZINC
GRASSELLI
EXPLOSIVES
DYESTUFFS

St. Louis, Mo.
Pittsburgh, Pa.
Wilkes-Barre, Pa.
Hazelton, Pa.
Birmingham, Ala.
Miami, Fla.

GRASSELLI EXPLOSIVES


MIDVALE
HOLLOW DRILL STEEL

CEMENT MILLS
Equipped with
EDGE MOOR
WASTE HEAT SYSTEMS
include:

Aetna Portland Cement Company
Bay City, Mich.
Alpha Portland Cement Company
(5 mills)
Asano Portland Cement Company
Japan (2 mills)
Atlas Portland Cement Co. of Kansas
Independence, Kans.
Cebu Portland Cement Company
Cebu, Philippine Islands
Chichibu Cement Company, Japan
Compania General de Asfaltos y Portland Asland, Barcelona, Spain
Crescent Portland Cement Company
Crescentdale, Pa.
Dewey Portland Cement Company
(2 mills)
Dexter Portland Cement Company
Nazareth, Pa.
Florida Portland Cement Company
Tampa, Fla.
Hawkeye Portland Cement Company
Des Moines, Iowa
Hercules Cement Corporation
Hercules (Stockertown), Pa.
Hinode Cement Company, Japan
Hokoku Cement Company, Japan
Huron Portland Cement Company
Alpena, Mich.
Ideal Cement Company
Fort Collins, Colo.
International Cement Corporation
(2 mills)
Iwaki Cement Company, Japan
Knickerbocker Portland Cement Co.
Hudson, N. Y.
Lehigh Portland Cement Company
(2 mills)
Marquette Cement Mfg. Co.
LaSalle, Ill.
Nagoya Cement Company, Japan
Newaygo Portland Cement Company
Newaygo, Mich.
Nippon Cement Company, Japan
Northwestern States Port. Cement Co.
Mason City, Iowa
Oita Cement Company
Asahi Works, Japan
Peninsular Portland Cement Company
Cement City, Mich.
Pennsylvania Cement Company
(2 mills)
Petoskey Portland Cement Company
Petoskey, Mich.
Pittsburgh Plate Glass Company
Zanesville, Ohio
Sandusky Cement Company
Bay Bridge, Ohio
Societe Anonyme des Chaux et Ciments
La Farge, Marseilles, France
South Australian Portland Cement Co.
Brighton, S. A.
Spalato Cement Company
Trieste, Italy
Tosa Cement Company, Tosa, Japan
Trinity Portland Cement Company
Eagleford, Tex.
Vulcanite Portland Cement Company
Vulcanite, N. J.

These 47 mills, with a combined production capacity of 150,000 barrels daily, are operating or have ordered more than 113,000 b.h.p. of Edge Moor Waste Heat Boilers.

An Investment
with Returns Guaranteed

THE purchaser of an Edge Moor Waste Heat System assumes no risk. He simply makes an investment on which the returns are definitely and specifically guaranteed in advance.

These returns will generally repay the entire investment in two to three years.

From inception to full completion, this company assumes responsibility for the installation of each Edge Moor Waste Heat System. Results to be accomplished are a part of the contract.

In every installation that has been made—including more than forty in cement mills—the results have exceeded the guarantee.

Let us show you what an investment of this sort would do to your operating profit.

EDGE MOOR IRON COMPANY
Established 1868
EDGE MOOR, DELAWARE
New York Chicago St. Paul Boston
Pittsburgh Charlotte Los Angeles

EDGE MOOR BOILERS
EDGE MOOR, DEL. U.S.A.

EDGE MOOR Water Tube BOILERS
FOR INCREASED FUEL ECONOMY

50 YEARS OF SERV

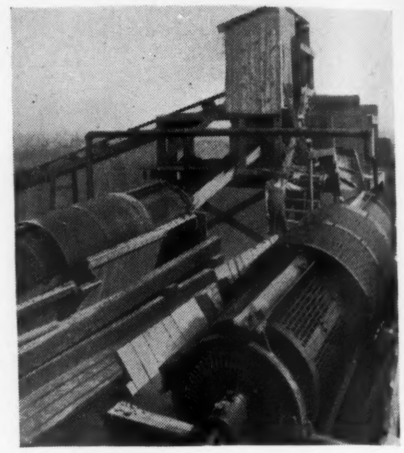
Bucket Elevators

56 standard types of Bucket Elevators for handling crushed stone, sand, gravel, coke, etc.

Heavy-Duty Bucket Elevators successfully handle stone, ores and cement clinkers up to 700 tons per hour.

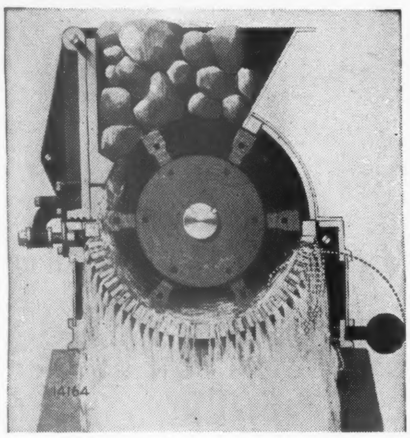
Revolving Screens

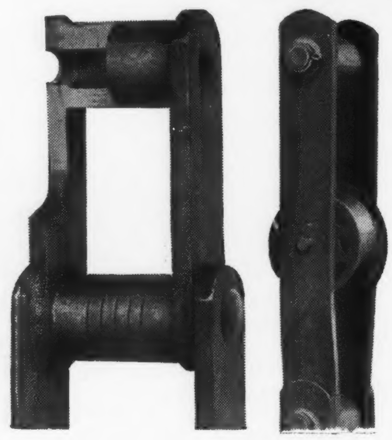
Jeffrey Improved Revolving Screens for washing and screening sand and gravel. Large scrubbing sections. High pressure spray pipes enter screen at both ends. All wearing parts renewable.



Crushers—Pulverizers

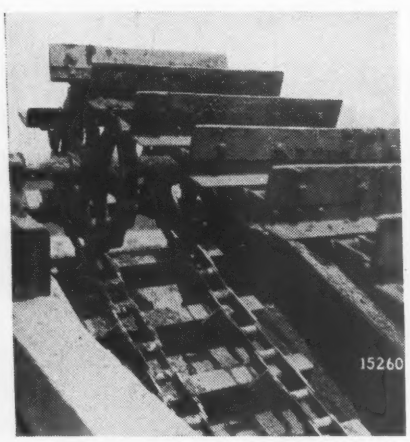
Jeffrey Crushers and Pulverizers are built in several types and sizes for reducing limestone, gypsum, shale, slate, clay, coal and similar materials.





Chains

There's a Jeffrey Chain for every drive, elevating and conveying requirement. Detachable Link, Hercules, Peerless, Steel Thimble, Drag and other types.



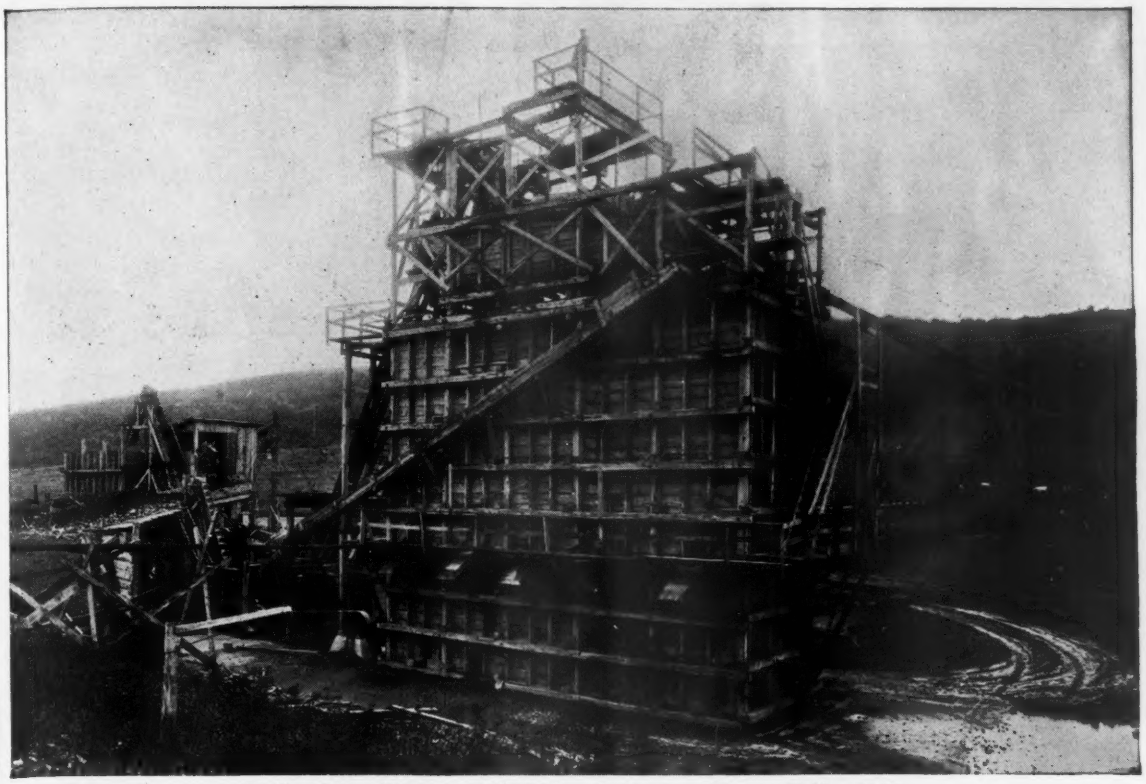
Sandwashers

A Jeffrey Sandwasher will dump 24 to 48 tons of clean sand into your bins every hour. The Special Hercules Chain with manganese block links resists the hard cutting action of the sand.

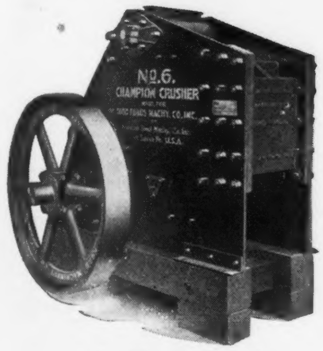
Portable Loaders

Jeffrey Portable Loaders and Conveyors are built in belt, scraper, and bucket types for handling sand, gravel, crushed stone, coal and similar materials.

JEFFREY



Sand and Gravel Plant furnished Chas. R. Stewart, Chenango Bridge, N. Y.



Good Roads Champion Rock Crusher No. 6 (11x26). Capacity 200 tons per day.

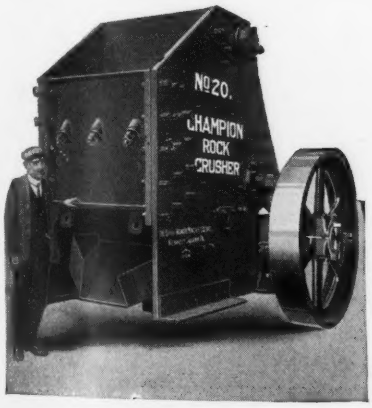
Plants that Make Profits!

FROM the ground up — that summarizes the scope of Good Roads service in designing and installing any type of plant, whether for the production of sand and gravel or for crushed stone. Our engineers analyze every factor of location, material, etc., to insure a proper layout. When they finish their job you can be certain your plant is technically correct for the work it must do—therefore will produce greatest possible profits.

Whether your problem is a new plant, or additions to present equipment, it will pay you to consult Good Roads engineers. No obligation.

The Good Roads name means durability and efficiency on elevators, elevator feeders, revolving screens, wash boxes, dredging excavators, dragline cableway excavators, rubber belt conveyors, bins, chutes and gates.

Write for Crusher Catalog K. A. U. or Sand and Gravel Catalog 5-A.



Good Roads Champion Rock Crusher No. 20 (22x50). Capacity 800 tons per day.

THE GOOD ROADS MACHINERY CO., INC.
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PORTLAND, ORE. . . . 3rd & Hawthorne St.
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NEW YORK, N. Y. . . . . . 50 Church St.
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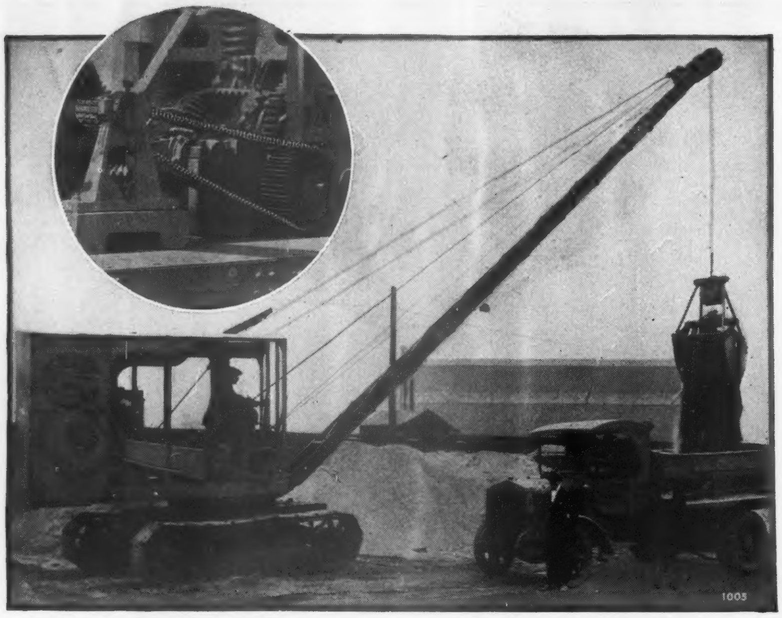
Good Roads MACHINERY



70 H.P. Silent Chain Drive from gas engine to driving mechanism of Byers Crane. Driver, 800 r.p.m.; Driven, 150 r.p.m.; 52-inch centers.

Be sure it's equipped with MORSE DRIVES

Morse Engineers are always available at:

ATLANTA, GA. .... 702 Candler Bldg. Earl F. Scott & Co.
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BOSTON, MASS. .... 141 Milk St.
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CHARLOTTE, N. C., 404 Commercial Bank Bldg.
CHICAGO, ILL. .... 112 W. Adams St.
CLEVELAND, OHIO .... 421 Engineers Bldg.
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If you buy machinery that's equipped with Morse Silent Chain Drives, you can be sure of dependable power. Morse Drives are used by such well-known manufacturers as:

Byers Machine Co.
Brownhoist Cranes
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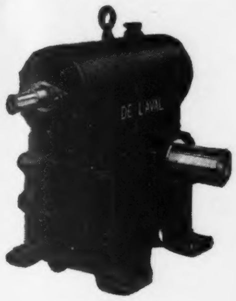
Whether revamping old equipment or buying new, you can depend on Morse Drives to transmit 98.6% of the power received. They are positive, flexible, durable. Ideal for short centers.

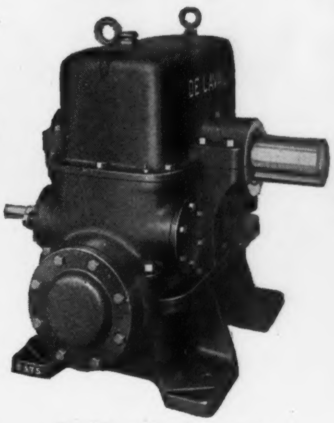
Morse Engineers are experienced in designing the drive to exactly fit the job. Consult a Morse Transmission Engineer at the nearest office.

MORSE CHAIN CO., ITHACA, N. Y., U. S. A.

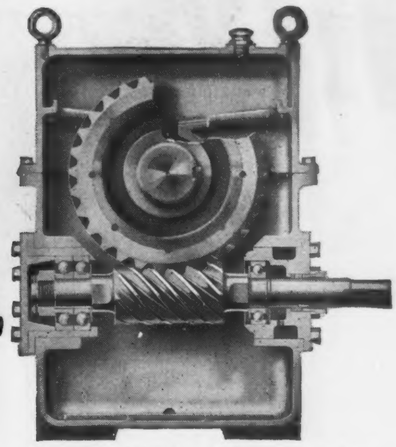
MORSE SILENT CHAIN DRIVES

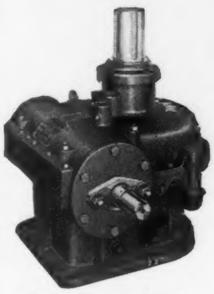
THE MORSE "ROCKER JOINT"

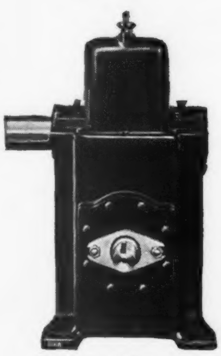

Top drive gear

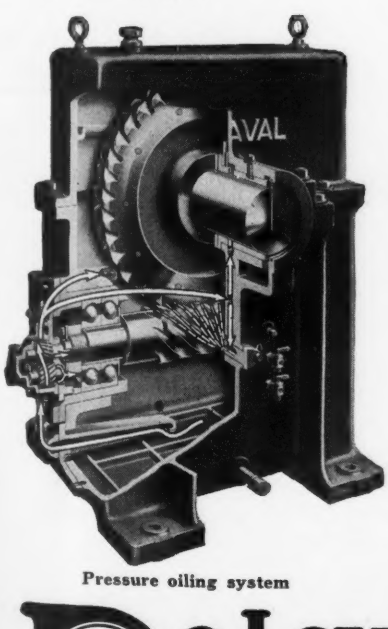

Double reduction gear

De Laval helical gear


Section of bottom drive gear taken through axis of worm shaft


Gear for vertical shaft drive


Bottom drive gear


Pressure oiling system

Superior Speed Reducers
for Every Service

THE DE LAVAL WORM REDUCTION GEAR is a scientifically developed modern speed reducer, built by improved methods and combining simplicity, high efficiency, reliability and compactness. All parts are machined to limit gages to insure correct operation and perfect interchangeability. The only moving parts are the worm, the worm wheel, and the ball bearings of the worm shaft. It is the silent, but indispensable, partner of the motor for electric drive of industrial equipment.

It is a great space saver. The only attention required is to see that the proper oil level is being maintained.

The worm can be placed either above or below the worm wheel, and the worm wheel shaft can be extended either to right or to left, or upon both sides.

The ample wheel bearings permit of using an overhung pinion or sprocket wheel where chain drive is desirable for flexibility.

The De Laval Worm Reduction Gear for vertical shaft drive avoids the need for bevel gears or vertical belts. Vertical drive frames are made with the wheel shaft brought out at the top or at the bottom.

The De Laval Double Reduction Worm Gear is used for ratios from 100 to 1 up to 8000 to 1. The slow speed bearings are of large size, to take care of the considerable forces involved in a high ratio reduction.

For high speeds or the transmission of high powers the De Laval Worm Reduction Gear is provided with a positive pressure oiling system.

For relatively low ratios of speed reduction the DE LAVAL HELICAL or TWISTED GEAR is greatly superior to spur gears as it is quiet in operation and the efficiency is high.

De Laval Steam Turbine Co.

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592

Manufacturers of Steam Turbines, Centrifugal Pumps, Centrifugal Blowers and Compressors, Double Helical Speed Reducing Gears, Worm Reduction Gears, Hydraulic Turbines, Flexible Couplings and Special Centrifugal Machinery

G-E Motorized

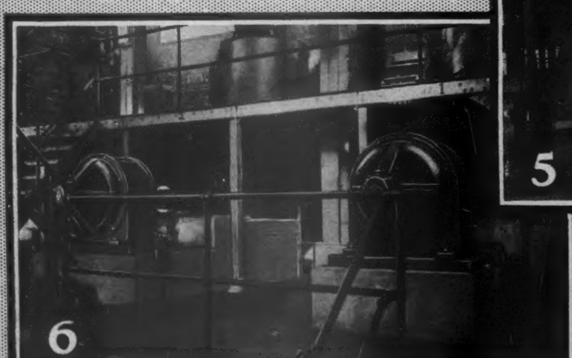
Insures

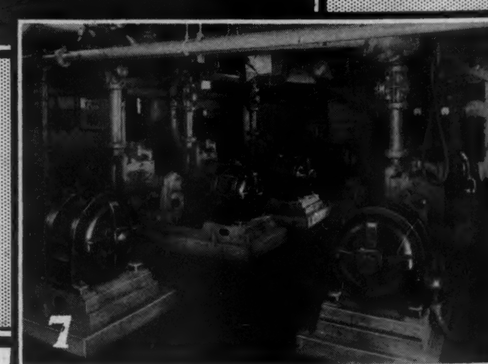
4 Material handling is admirably cared for by G-E motorized conveyors. Here is a double-pan conveyor driven by a G-E motor in a large lime plant.

5 The famous G-E Super-synchronous motor has no equal in the driving of slow-speed, high-starting torque loads. Three such motors of 500 h.p. each are shown driving raw-grinding tube mills.

6 Two G-E 75-h.p. induction motors driving coal pulverizers.

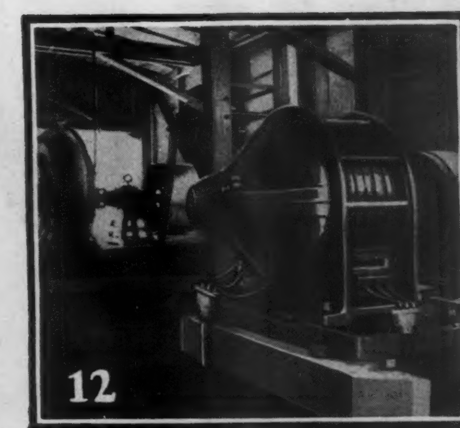
7 Six G-E 30-h.p. induction motors operating slurry pumps in one of the most modern of wet-process plants.





GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.



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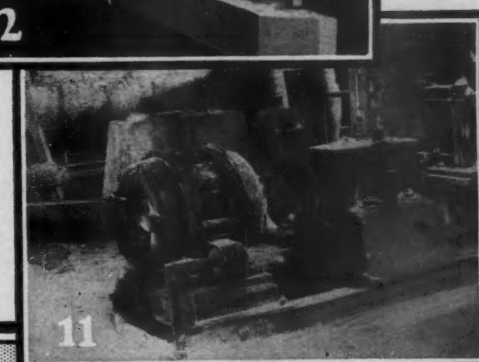

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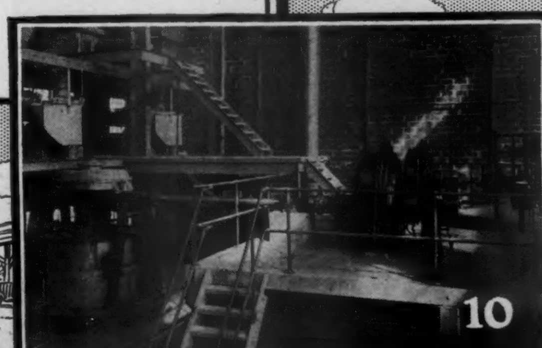

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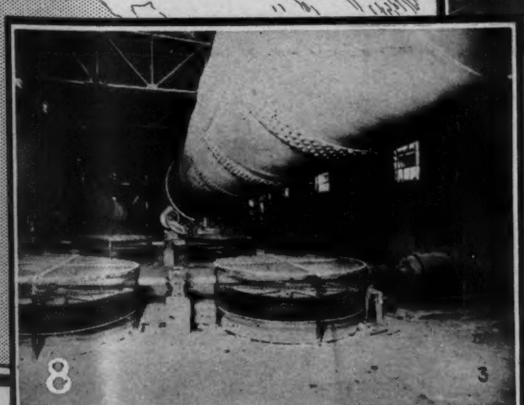

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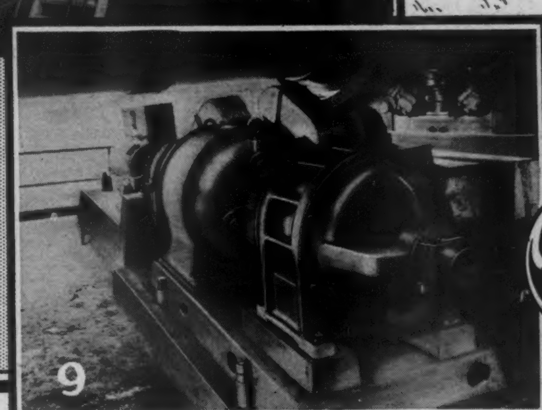

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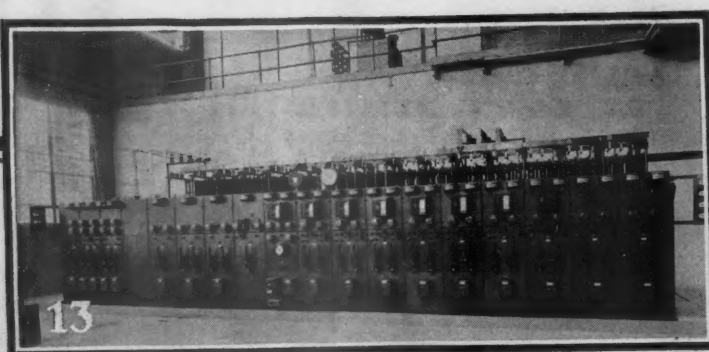
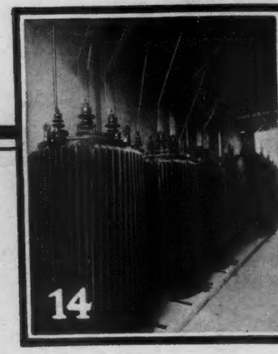
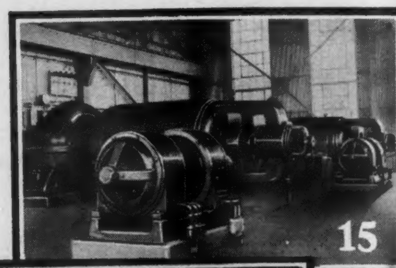




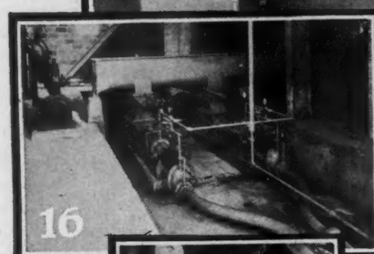
Consider this cost ratio

when you consider electrification



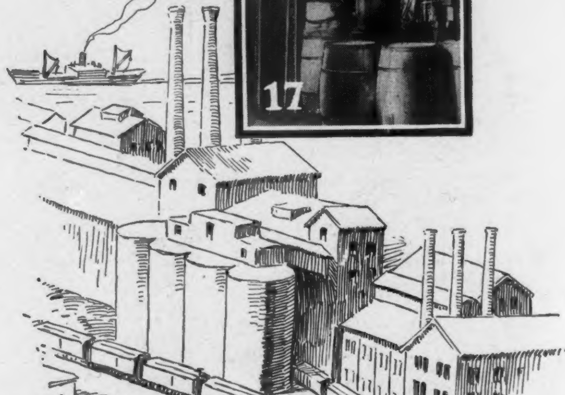
In the October 1926 issue of PUBLIC ROADS, published by the U.S. Bureau of Agriculture, the following statement is contained in an article entitled; "Direct Production Costs of Broken Stone":

> "The kind of power used has much to do with costs. The more extensively electricity is used, the more economically are most of the operations conducted."



In other words, the reduction of your operating costs is proportionate to the extent of your electrification.

Bear in mind for the coming year that the success of any electrification depends upon high-quality equipment, correctly applied, correctly co-ordinated —the three fundamentals of G-E Motorized Power.



13 Typical G-E switchboard installation in a southern cement plant.

14 Bank of efficient and economical G-E transformers in a cement plant.

15 G-E turbines utilizing the waste heat from cement-mill kilns. G-E turbines are the recognized standard.

16 Extracting the fullest efficiency from cement pumps by operating them with G-E Motorized Power.

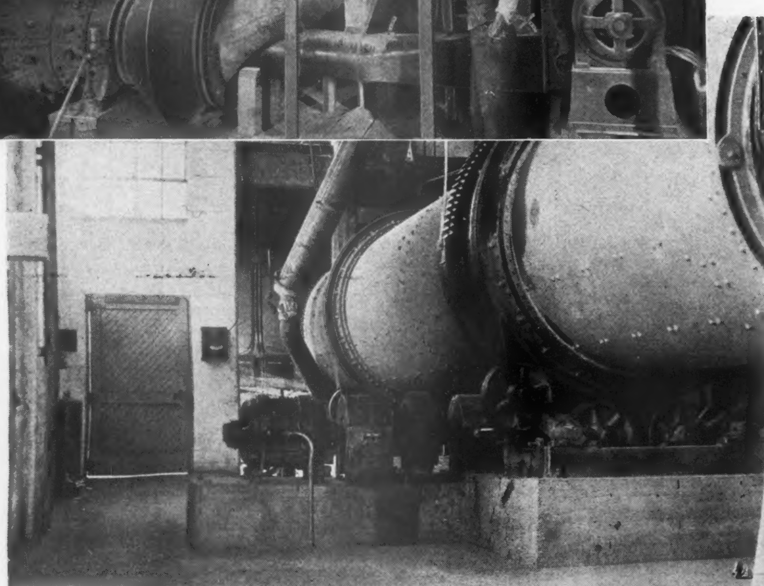
17 G-E motors driving barrel-packing machines in a large eastern lime plant.

200-39

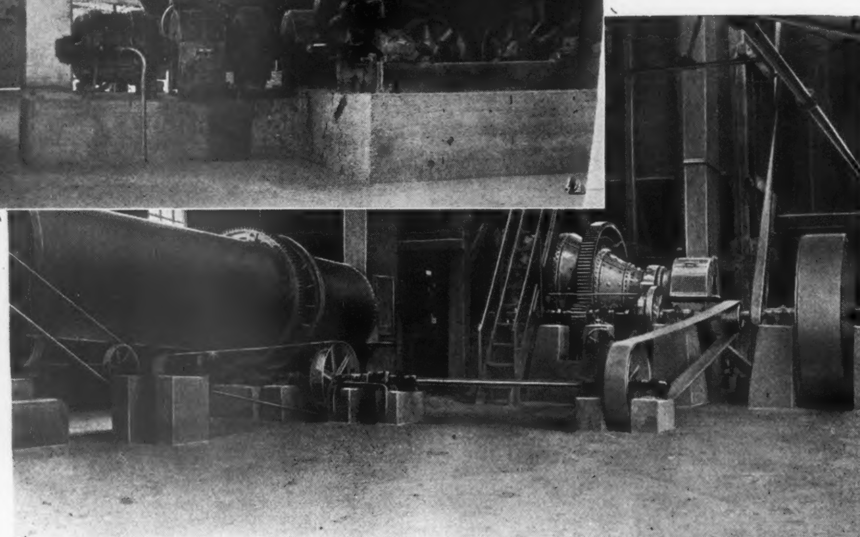
GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

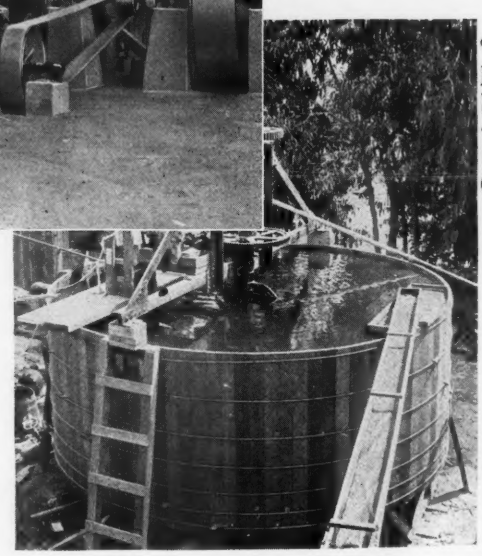
Grinding Silica in a Hardinge Conical Mill and Reverse Current Air Classifier



Ruggles-Coles Dryer in a Cement plant



Hardinge Conical Mill and Ruggles - Coles Dryer in Limestone plant



Filtering boiler feed water in Hardinge Clarifier

HARDINGE COMPANY
YORK, PENNSYLVANIA

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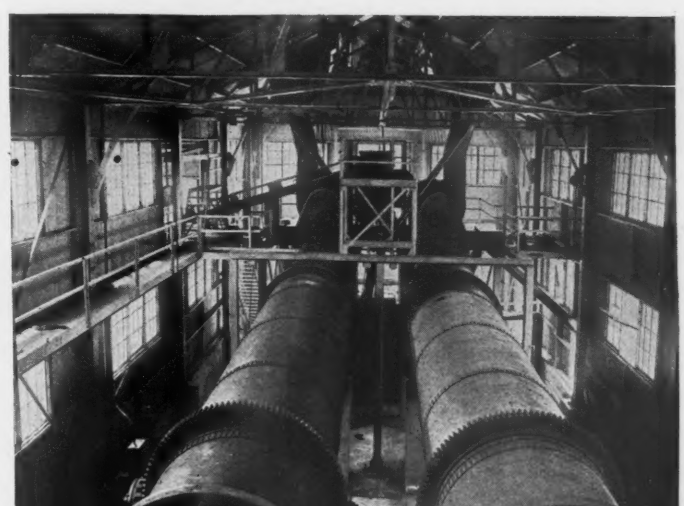
HARDINGE

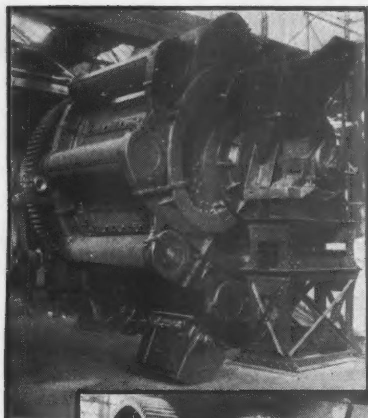
Hardinge Mills grinding Cement Clinker



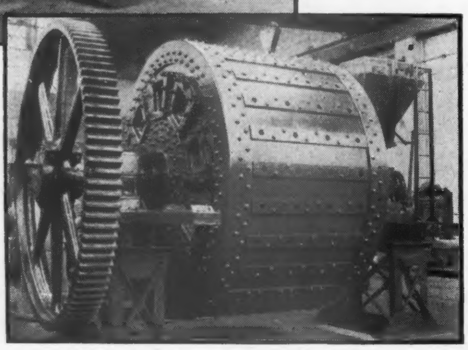
Ruggles-Coles Dryers in Coal plant

HARDINGE

Cement Making Machinery



KOMINUTER machine of the ball-mill type for dry granulating



Kominuter for wet granulating

COOLERS rotary pressure coolers for cement clinker

KILNS special equipment, as hoods, interior devices, dampers, spouts, etc.

COAL FEEDERS for feeding pulverized coal to kilns

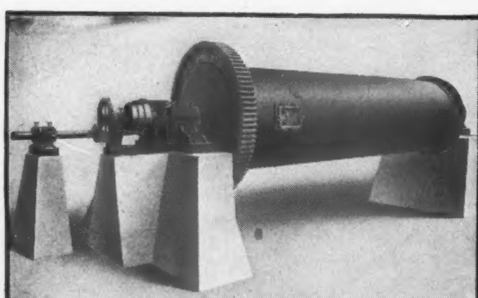
COAL BURNERS for rotary kilns

OIL BURNERS for rotary kilns

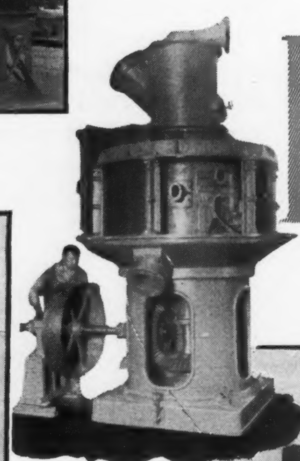
SLURRY FEEDERS for slurry, to kilns, tube-mills, kominuters, etc.

CRADLE FEEDERS for crushed coal, rock, clinker, etc.

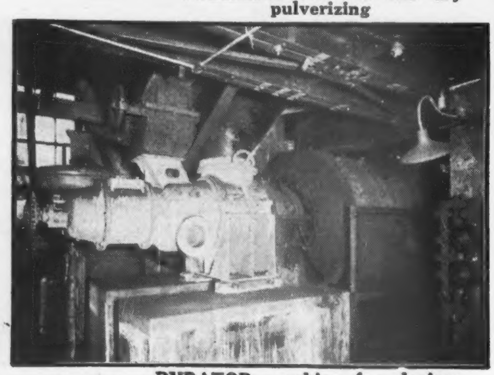
The machines illustrated, as well as those listed, represent our complete line of equipment for the manufacture of portland cement by either the wet or dry process. These products are the result of more than forty years experience in engineering and in the development of machinery specifically for the portland cement industry.



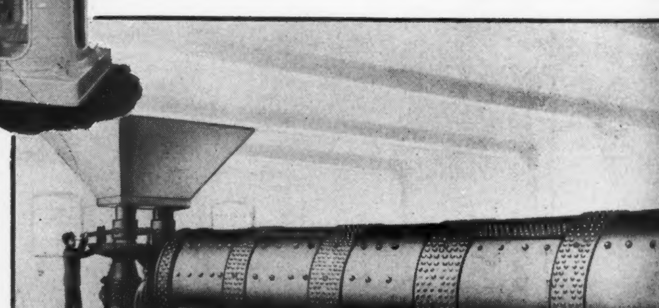
TUBEMILL for wet and dry pulverizing

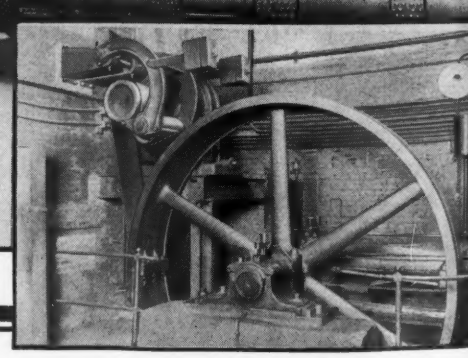


TRIX for grading granulated materials in a wet state



PYRATOR machine for drying, granulating and pulverizing





LENIX short center belt drive

F. L. Smidth & Co., Inc.

ENGINEERS

50 Church Street

DESIGNERS AND EQUIPPERS OF CEMENT MAKING FACTORIES

Factory, Foundry and Laboratory—Elizabeth, N. J.

New York City

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Cement Making Machinery

TABLE FEEDERS for crushed coal, rock, clinker, etc.

TAKEUPS for slurry elevators

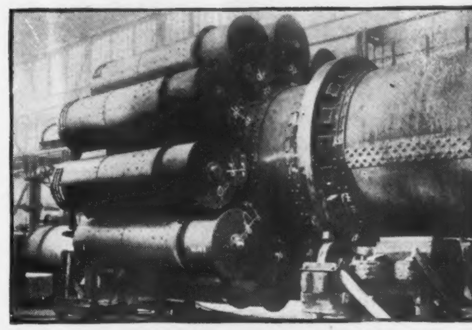
CYLPEBS metallic cylindrical grinding bodies for tubemills

FLINTS Danish flint pebbles for tubemills

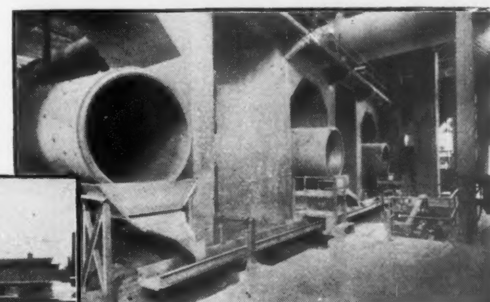
DRAGPEB metal lining for tubemills

SILEX flint stone linings for tubemills

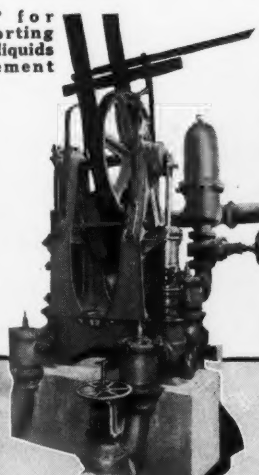
MOLER insulating bricks for kilns, etc.



UNAX special revolving cooler

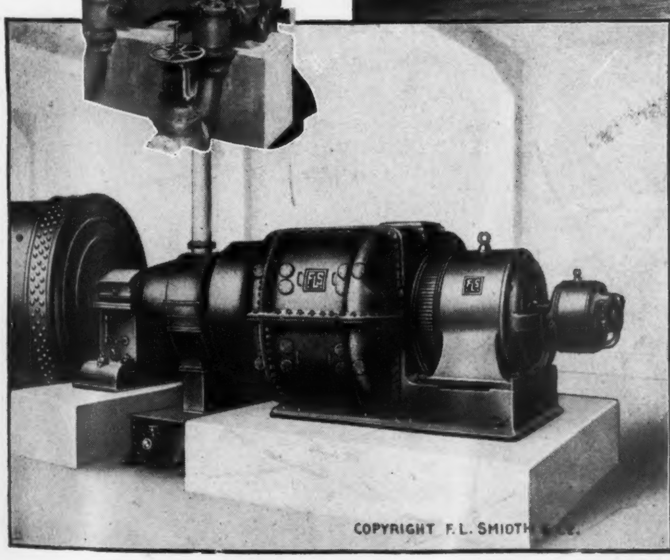


SKIPULTER shaker conveyor for transporting dry granular materials

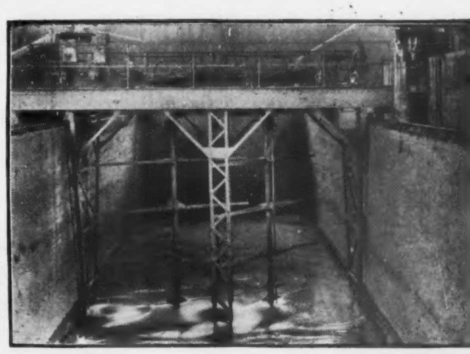


PUMP for transporting heavy liquids like cement slurry.

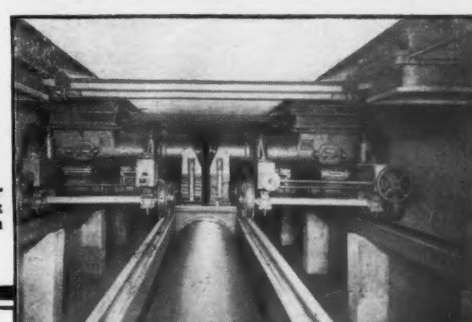
WASHMILL for disintegrating and mixing clay and like materials in water



UNIDAN compartment machine for granulating and pulverizing



AGITATORS for mixing wet composition and retaining it in intimate mix



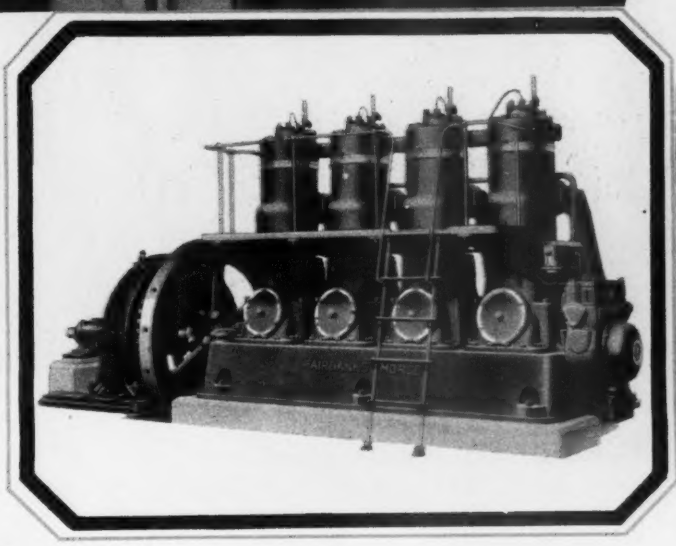
EXBINER for handling bulk cement from storage

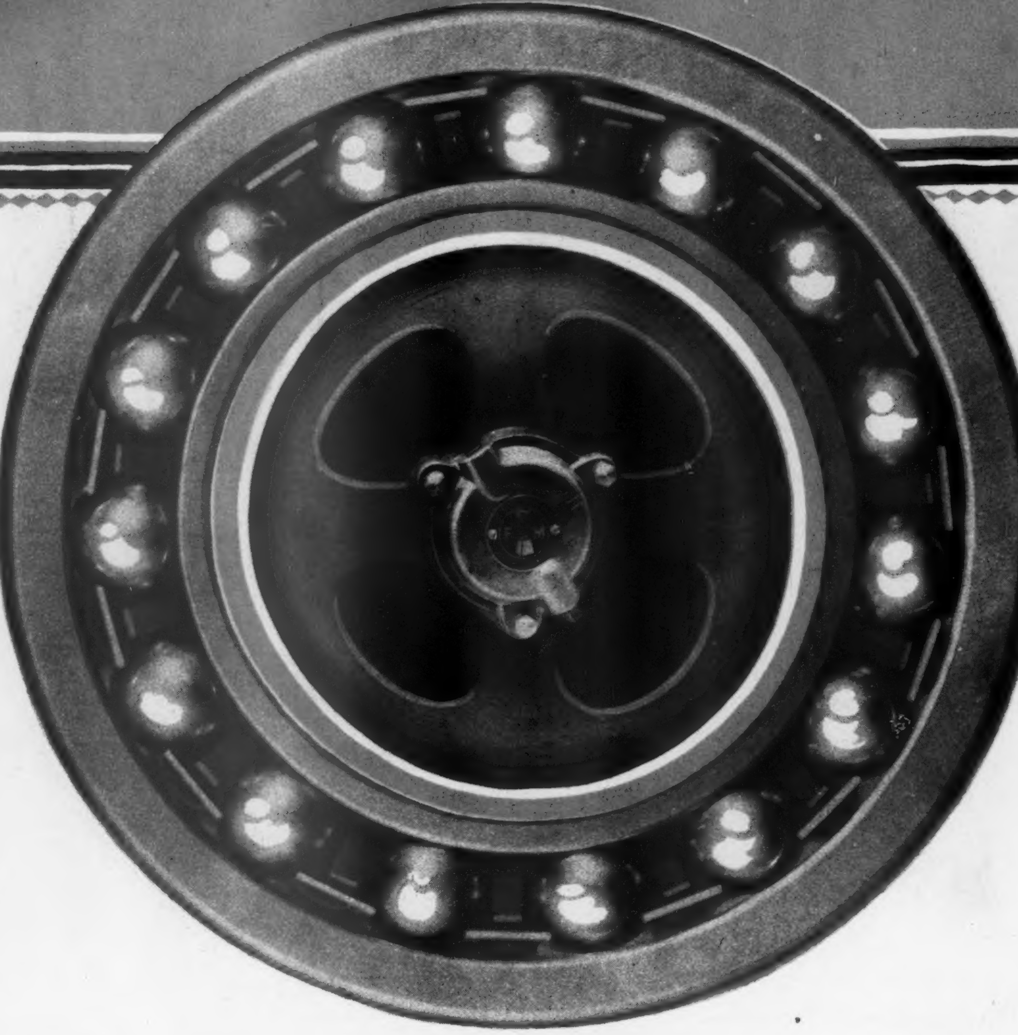
F. L. Smidth & Co., Inc.

ENGINEERS

50 Church Street — DESIGNERS AND EQUIPPERS OF CEMENT MAKING FACTORIES — New York City

Factory, Foundry and Laboratory—Elizabeth, N. J.


FAIRBANKS MORSE



This pioneering step

has made most motor failures inexcusable

Statistics are not available, but your own experience will tell you that the great majority of motor troubles and failures are directly traceable to bearings.

Fairbanks-Morse recognized this fact first. Brought out the first complete line of general purpose *ball-bearing* motors. Replaced the time-honored sleeve-bearing with a trouble-eliminating ball bearing. Made most all motor failures inexcusable!

If this were the one contribution of Fairbanks-Morse to motor progress, it would still stand out as the greatest recent step in motor development. Actually it is only one of a number of great features that have been developed in F-M Ball-Bearing Motors.

FAIRBANKS, MORSE & CO., *Chicago*
28 branches throughout the United States at your service

FAIRBANKS-MORSE

Pioneer Manufacturers of

ball bearing motors

A(EO)A05. 4

GET THIS BOOK

You need this new book! It tells the story of Kruzite and Mizzou— A. P. Green's High-Alumina (Diaspore) Fire Brick. Write for your copy.

For Boiler Settings

KRUZITE

The Super Refractory! A Diaspore brick that stands up under heats far above what is expected of the best fire-clay brick. Has remarkable load-bearing qualities under heat.

MIZZOU

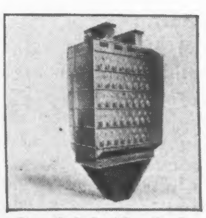
Another high Alumina (Diaspore) FireBrick, with high resistance to heat. Desirable for fluctuating temperatures and heavy loads—especially adapted for super boiler settings.

A.P. GREEN FIRE BRICK CO.
MEXICO, MISSOURI

Kruzite Kiln Liners—Often give service of from three to five times that given by fire-clay liners. That's why the cement and lime industries are among their leading users.

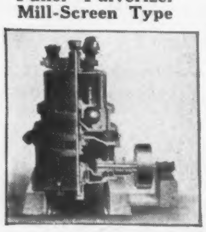
Keeping the pace

On this page (above) is shown an installation of Fuller-Lehigh Pulverized Coal Equipment which has seen twenty years continuous service. On the opposite page (at top) is shown an installation in a recently-completed Eastern cement plant. There, in brief, you have the story of Fuller-Lehigh's keeping pace with the cement industry. Fuller-Lehigh pulverized coal equipment of twenty years ago is still in use, and Fuller-Lehigh pulverized coal equipment of today is being installed in new cement plants throughout the country.



Randolph Vertical Waste Heat Drier

Fuller Pulverizer Mill-Screen Type

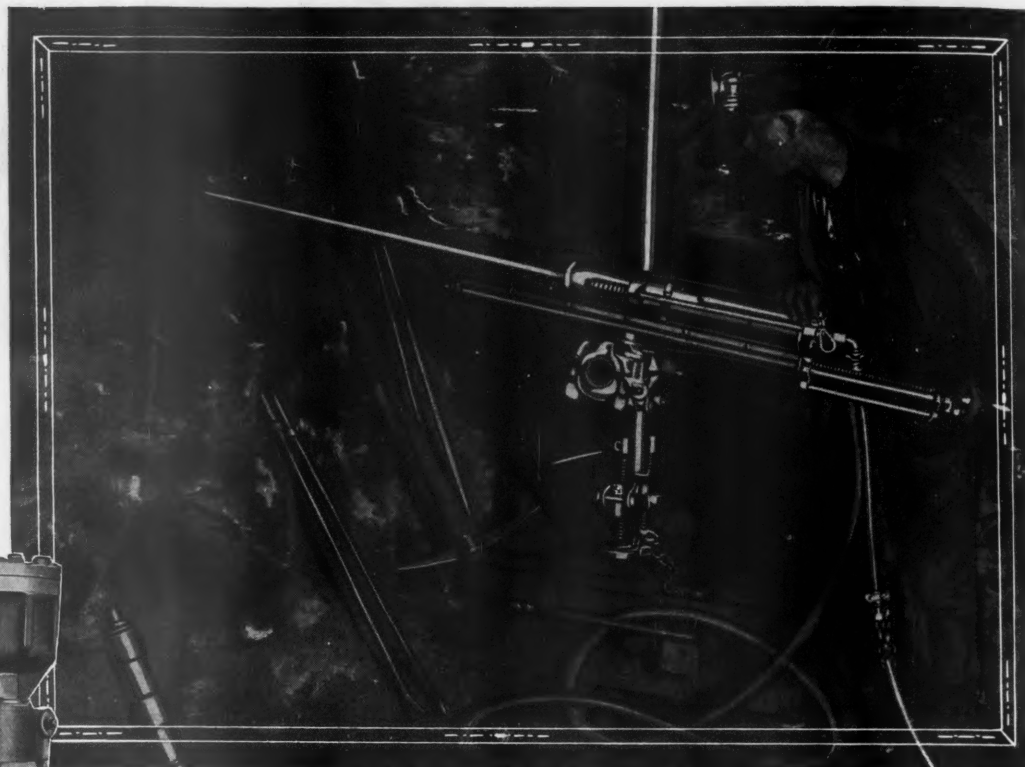


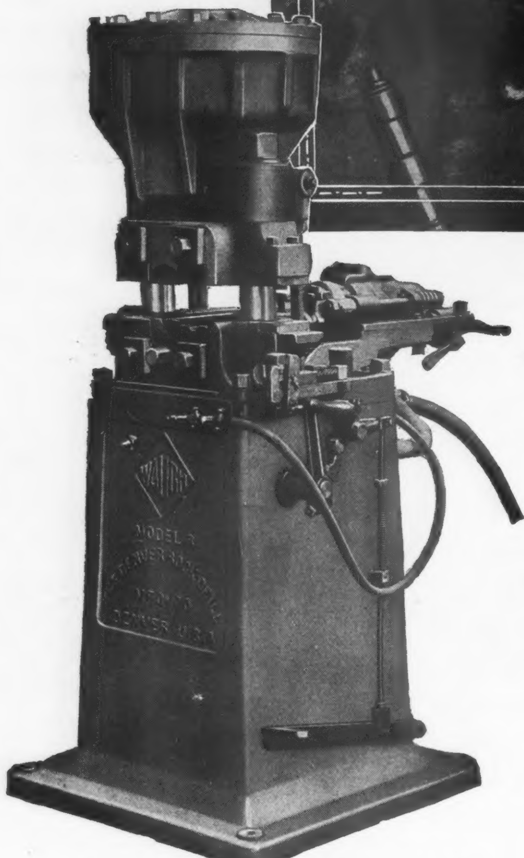
A recent Fuller-Lehigh installation of pulverized coal conveying equipment in a prominent new Eastern cement mill.

FULLER-LEHIGH COMPANY, Fullerton, Pa.

(A BABCOCK & WILCOX ORGANIZATION)

New York, Fuller-Lehigh Co., 50 Church St.
Chicago, Acers Poppenhusen Co., McCormick Bldg., 332 So. Michigan Avenue
Boston, H. H. Leathers, 80 Federal St.
Salt Lake City, Harrison & Co., Atlas Block





WAUGH ROCK DRILLS

for all types of quarrying

Use the Waugh Model 8 Drill Steel Sharpener, where drill steels in any large quantity are used. Better drill steels will result. Bits true to gauge, with accurate cutting edges, are easily and quickly made. Lugged or collared shanks are forged with equal facility.

For primary and secondary drilling on open quarries, the Waugh "Turbo" Drills. For underground quarrying, the Waugh Model Seven (above). For specialized drilling problems, special types of Waugh Drills.

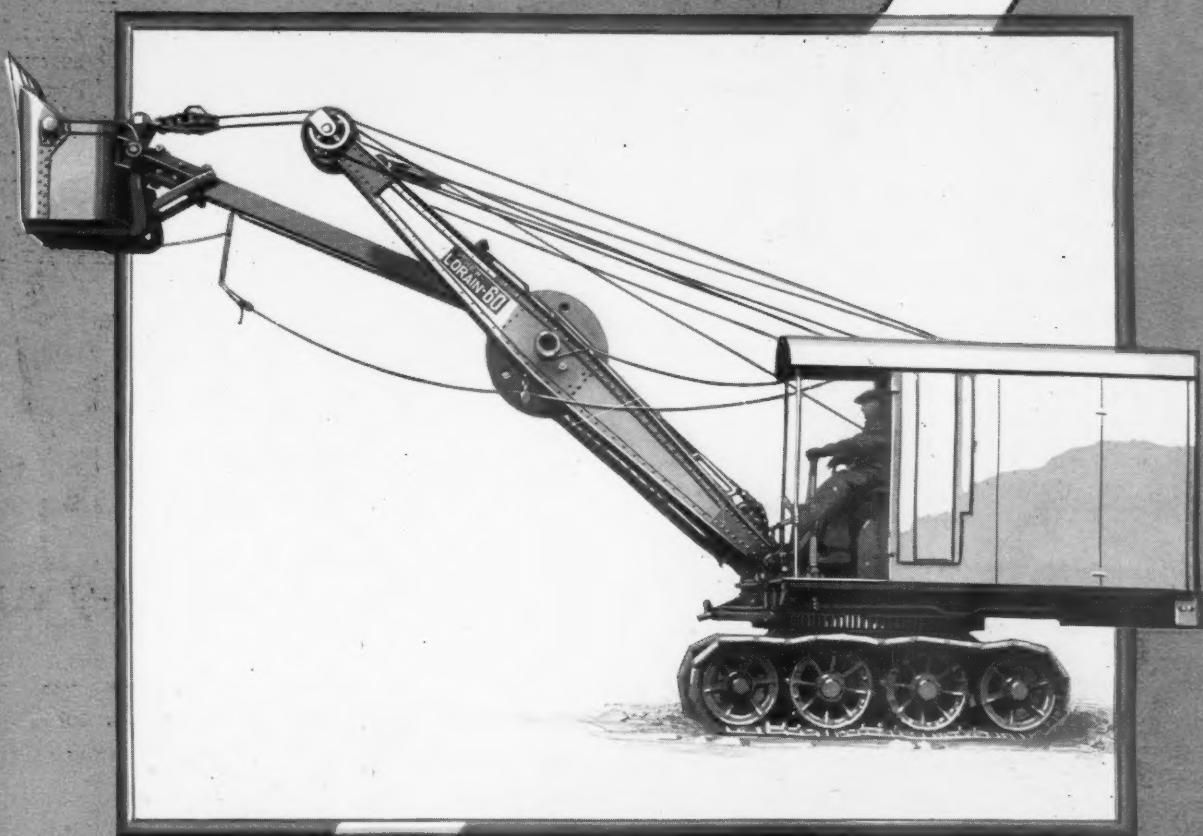
Waugh Rock Drills are fast, hard-hitting, long-lived, and remarkably easy to handle. Mounted on a Derrick, they may be moved about on the job with unusual facility.

Let us give you concrete evidence of the savings made by the use of Waugh Rock Drills as many prominent quarries. Let us show you how standardizing on Waughs will assure maximum daily footage, and at the same time reduce repair and labor costs. Write for bulletins, telling us nature of your quarrying proposition. No obligation.

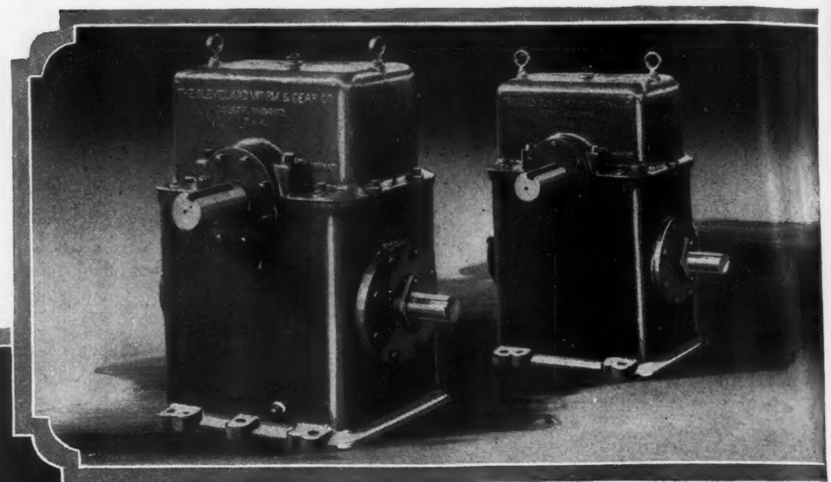
THE DENVER ROCK DRILL MANUFACTURING COMPANY

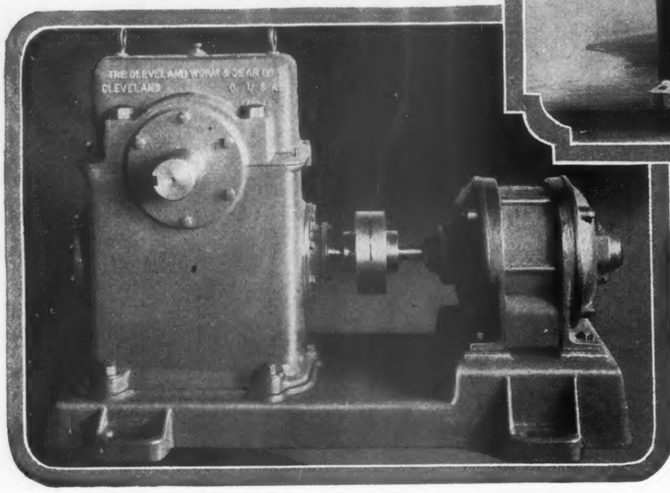
DENVER COLORADO

Branch Offices and Stocks in All Important Centers


LORAIN-60

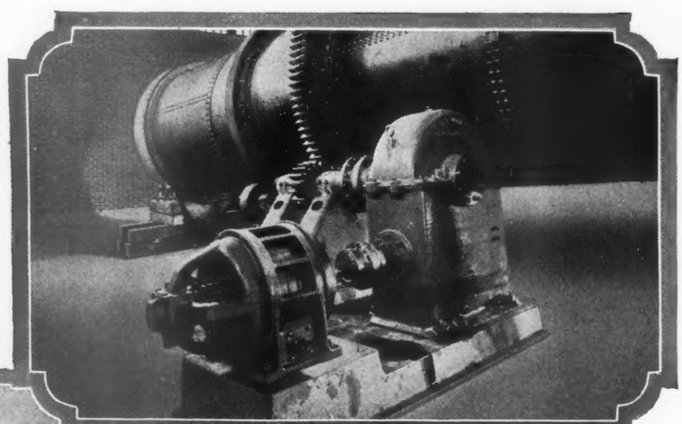
Efficient in Operation

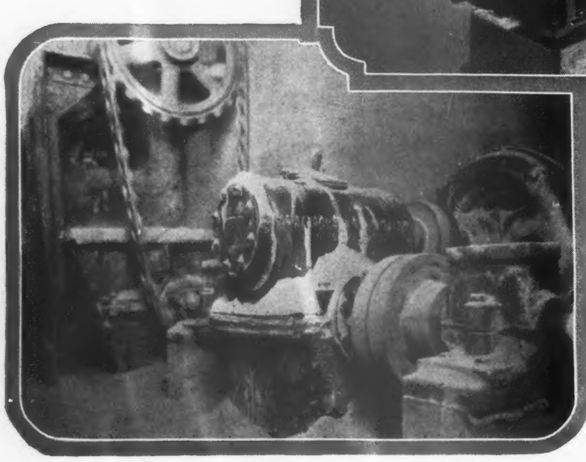




Cleveland Industrial

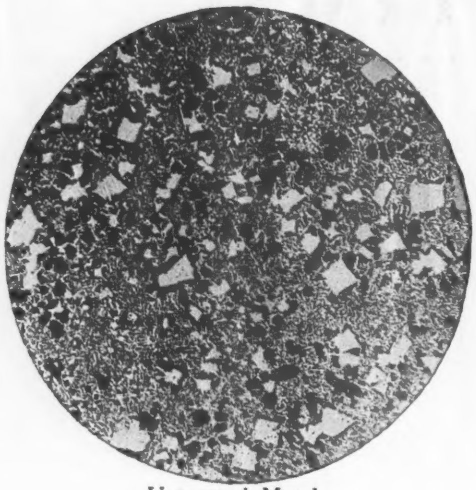
WHEREVER continuous operation, economical service and efficiency in power transmission are desired, the Cleveland worm gear drive merits careful consideration. The Cleveland drive was the pioneer of the modern high-efficiency worm gear reduction units and represents the highest development in this type of equipment. Cleveland power transmission units are built in a plant that has been devoted, for fifteen years, to the manufacture of worm gearing exclusively. Practically all varieties of equipment in rock products plants are being driven successfully through Cleveland Worm Gear Reduction Units. These include kilns, coolers, dryers, bucket elevators, drag conveyors, feeders, belt conveyors, screw conveyors, agitators, screens, fans, bag cleaners, pan conveyors, mixers, hydrators, etc. Low maintenance costs; no production delays. That's service.





THERE is a standard Cleveland worm gear unit to meet every requirement of industrial power application. Horizontal units are furnished with the worm above or below the gear and with the gear shaft extended at either or both sides. Another type of horizontal unit will accommodate an overhung gear or sprocket without an outboard bearing. Vertical units and double reduction units are also available. Standard bedplates for motor and drive can be furnished. The most difficult requirements can usually be suited with standard Clevelands.

Better Babbitt Metal



Untreated Metal

Metallographs
by
Pittsburgh Testing Laboratories
Magnification: 100 Diameters

Cadman BEARITE

Mechanically Correct

Cadman Bearing Metals can be guaranteed to double the life of the great majority of bearings because they are mechanically correct.

This guarantee, backed by sixty-six years' carefully guarded reputation for honest products at an honest price, may not be overlooked.

The microphotograph to the left above is that of an exceptionally high-grade lead-base babbitt. Antimony, the essential hardening material, instead of being uniformly distributed, is scattered irregularly through the compartively soft base in the form of extremely hard, brittle crystals.

The microphotograph to the right is Cadman BEARITE. The analysis of the two metals is identical, but the hardening in the Bearite is uniformly distributed through the metal and the objectionable crystals are eliminated.

We ask you, as an engineer, which metal is structurally correct and which will give the better service?

For many years Cadman BEARITE has given highly satisfactory service in Gyratory Crusher Eccentric and Jaw Crusher Bearings.

Send for our Engineering Bulletins M1 and M2, dealing with Bearings and Bearing Metals in general and Cadman Metals in particular.

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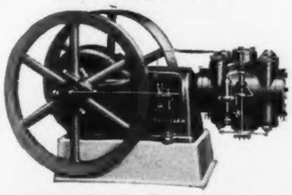
A·W·
Cadman
Manufacturing Co.
Pittsburgh
Pa.

Master Makers of Fine Bearing Metals
Since 1860


X·F·38

Sullivan Quarry Equipment

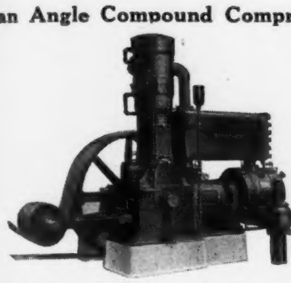
Sullivan "WG-6" Single Stage Air Compressor



"WG-6" Air Compressor

Sullivan "WG-6" is a rugged, smooth running, practically automatic, belt-driven compressor, with capacities from 68 to 500 cu. ft. All working parts are tightly enclosed to exclude dirt, and run in an oil bath. Cylinder is oiled by reliable force feed lubricator. Sullivan "Wafer" inlet and discharge valves aid compression efficiency. An inlet valve unloader is available on this machine, to cut off the supply of an unloader when the pressure in the receiver has reached the desired point. *Complete catalog 2483-B.*

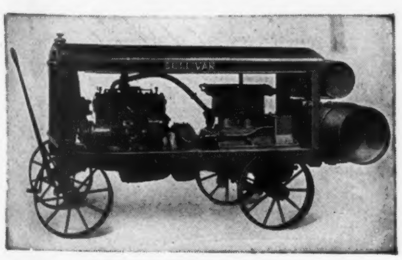
Sullivan Angle Compound Compressors



"WJ-3" Belt Driven Angle Compound

The unique angle compound design permits an exact balance of moving masses and forces, preventing vibration, reducing power waste, and making possible the use of smaller foundations. Capacities range in single units from 400 to 1800 cu. ft.; twin units 800 to 3700 cu. ft. Lubrication is positive and automatic; "Wafer" inlet and discharge valves, multi-step load control and three-pass counter-flow copper intercooler are features of this machine. Angle compound design permits easy direct connection to a motor or to an oil engine. *Complete catalog 2483-A.*

Sullivan Portable Compressors



"WK-312" 110-ft. Portable Compressor

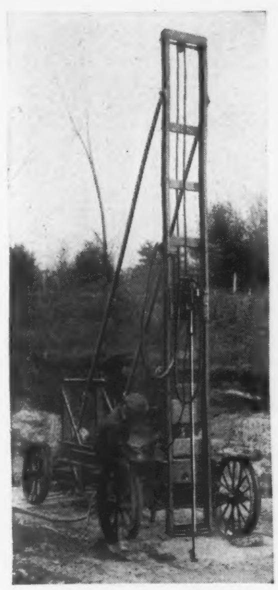
Sullivan portable air compressors are built in capacities from 103 to 320 cu. ft., and are driven by Buda engines or electric motor. 206 cu. ft. machines and larger, have the cylinders set in pairs at 90° with each other, mounted on a common crankshaft, eliminating vibration. Compressors are available on steel wheels, rubber-tired trailer trucks, skids, or ready for mounting on a truck. *Complete catalog 2483-D.*

Sullivan "DW-64" Water Drills

Sullivan "DW-64" water drills are high power, water jet, hammer drills, sturdy, fast-drilling

"DW-64" on Tripod

in hard ground or soft, convenient to handle and running in splendid balance. Separate air and water throttles. Automatic rotation. Sullivan Differential Spool Valve gives fast, positive action. May be fitted with a long shell for down hole drilling from a tripod or quarry bar, or wagon mounting. Wagon mounting shown in the picture weighs 3000 lbs. and permits a 15 ft. length of feed. Drills 25 ft. holes easily for 1¼ in. powder. *Get catalog 5881-E for full information.*

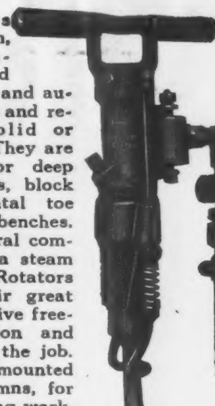


"DW-64" on Wagon Mounting

Sullivan Diamond Drill Test Borings

When examining quarry property, write to the contract drilling department of this company. We have been in the drilling business since 1884 and are ready to undertake prospecting on contract anywhere, with up-to-date Sullivan Diamond Drills and the latest appliances for recovering full core and getting accurate information.

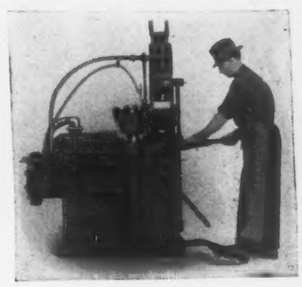
Sullivan "Rotator" Rock Drills



Sullivan Rotators are 43 lb., one-man, self-rotating hammer drills, equipped with steel retainer, and automatic lubrication and requiring ⅞-inch solid or hollow drill steel. They are recommended for deep drilling in quarries, block holing or horizontal toe hole work on high benches. In addition to several compressed air types, a steam drill is available. Rotators are noted for their great drilling speed, relative freedom from vibration and ability to stay on the job. Rotators may be mounted on tripods or columns, for down hole or drifting work. *Complete catalog 2481-F.*

"DP-331" Hollow Piston Rotator

Sullivan All-Hammer Drill Sharpener



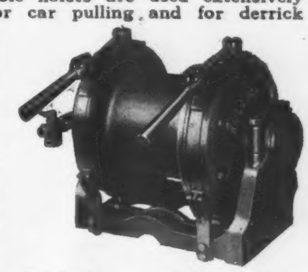
"A" Sharpener

Drill steel forged by hammer blows in a Sullivan All-Hammer Sharpener will cut faster, go farther without resharpening, and be less liable to breakage. Bits of any shape can be hammered out on a Sullivan sharpener, and hollow steel is handled easily; bits are uniform in shape and gauge, whether you make 2 or 2000, and follow accurately in the hole. *Complete catalog 2472-J.*

Sullivan Drill Steel Furnaces

Sullivan furnaces heat drill steel slowly and uniformly without waste. Pyrometer control enables all steels to be heated to the exact temperatures desired for either forging or tempering. Sullivan furnaces are available for heating by oil or gas. *Complete catalog 2474-B.*

Sullivan Portable Hoists



Single Drum Turbinair Hoist

Sullivan portable hoists are used extensively in quarries for car pulling and for derrick work. They are made in single and two-drum models, for air, steam or electric power. They will lift a ton vertically on single line at 110 feet per minute, or pull a 50-ton car on level track. *Complete catalogs 2476-F (Turbinair hoists) or 2476-G (electric hoists).*

Sullivan Machinery Company

82 East Adams Street **Chicago, Illinois, U. S. A.**

Boston, New York — Cleveland, Duluth — St. Louis, Knoxville — Pittsburgh, Salt Lake City — San Francisco, Spokane

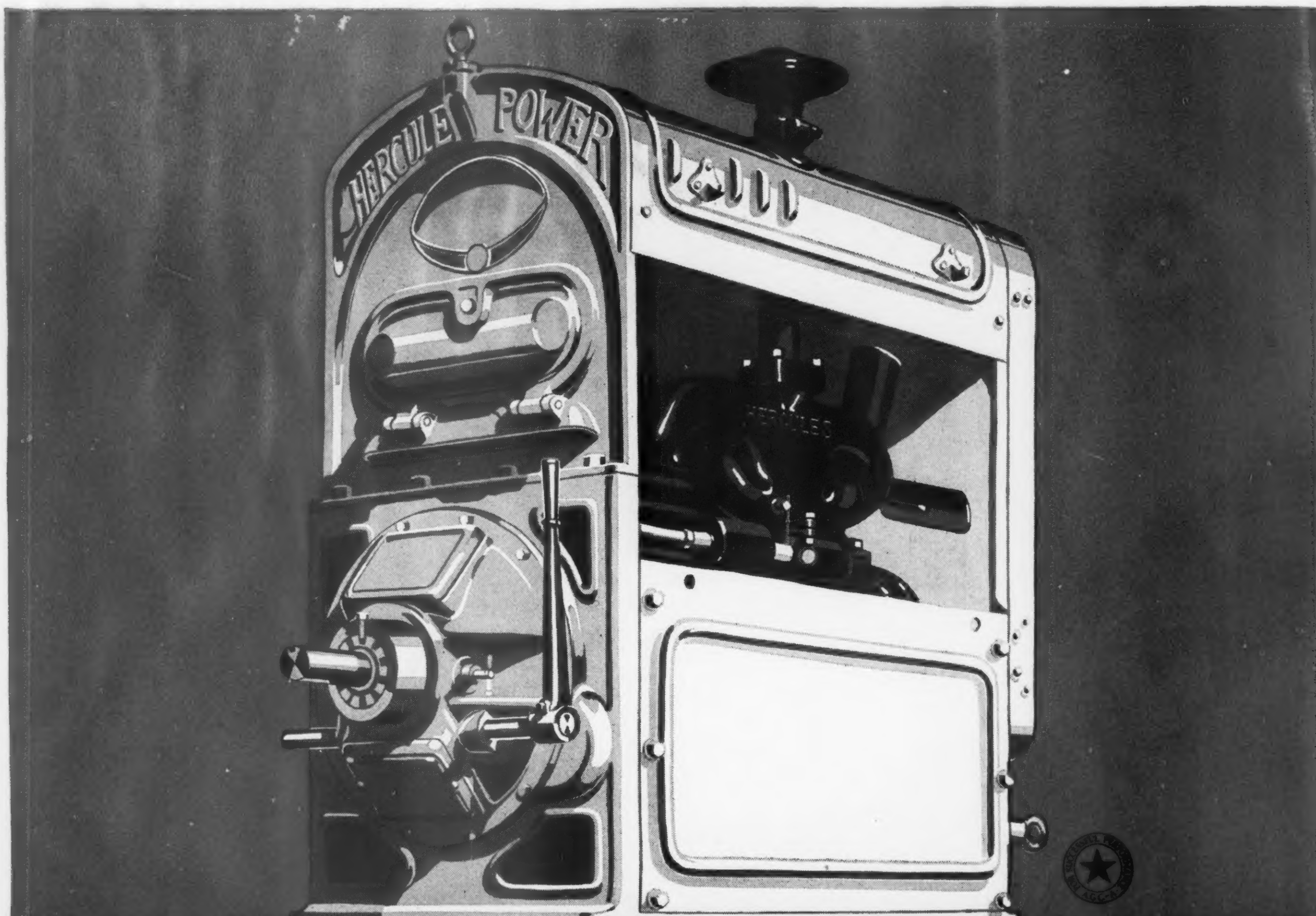
NEW RAILS AND TRACK MATERIALS

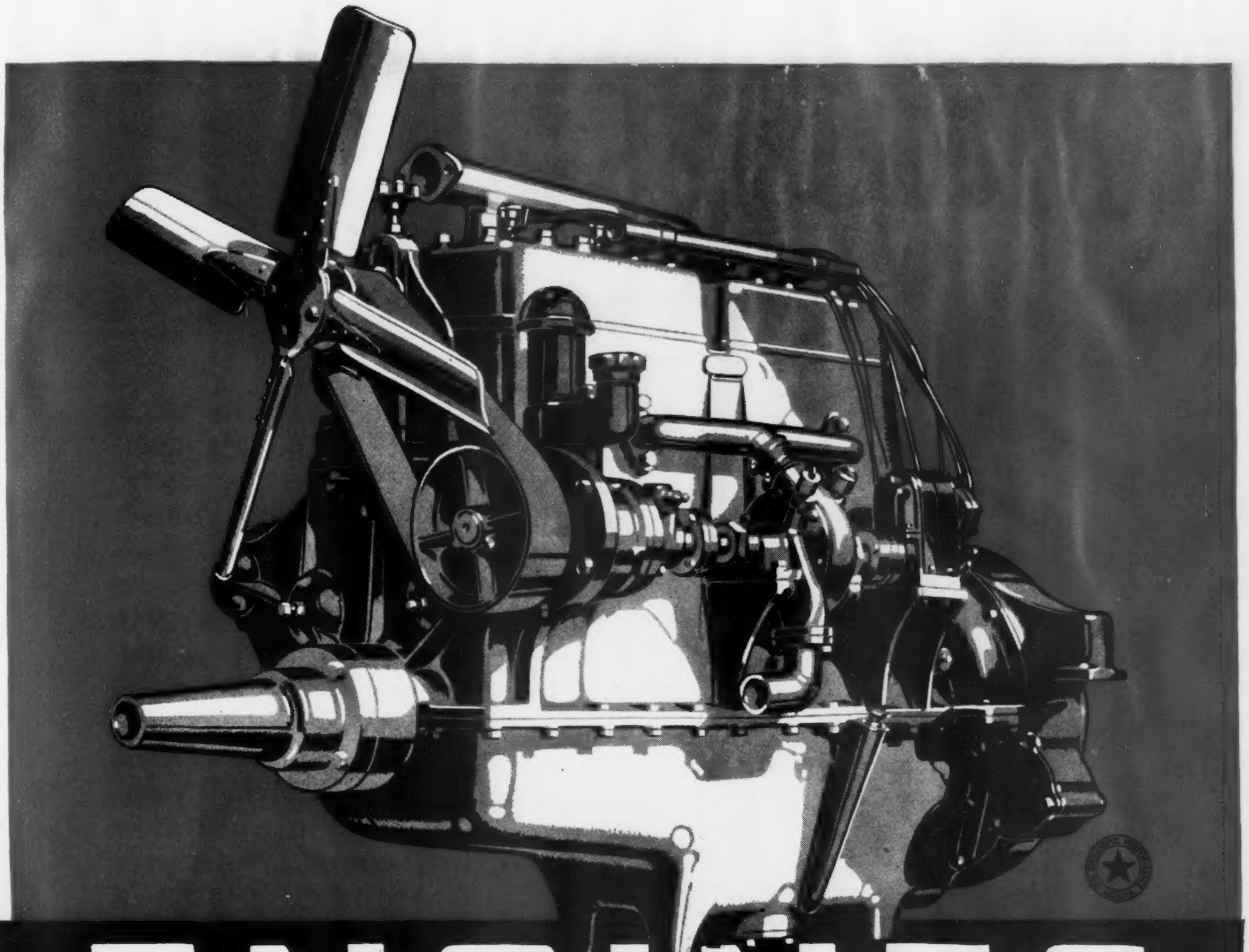
Foster supplies regularly, New Steel Rails and Track Accessories for Complete Installations and for Repairs or Extensions, to many of the largest Quarries in this country—with complete satisfaction as to QUALITY, SERVICE and GUARANTEE.

"PRICES,"—well, just ask for them—"1 Ton or 1,000"

L·B·FOSTER COMPANY

PITTSBURGH · CHICAGO · NEW YORK


HERCULES POWER



ENGINES

Such leadership must be earned! It has been. For Hercules engineers have added, to a superior engine whose design keynote is SIMPLICITY and whose manufacturing standard is PRECISION, a "personal engineering service" that wins--and holds--esteem.

HERCULES MOTORS CORPORATION

CANTON, OHIO, U. S. A.

Making both ends MEET

Every industry that turns a wheel must make both ends meet. And making belt ends meet is no small factor — production considered. Production depends upon the belt; the belt in turn upon its joining. Continuous production is the goal — eliminating unnecessary losses in time and labor. Many modern plants, by the standardization of Crescent Belt Fasteners, have reduced belt joining troubles to a minimum — added to their continuity of production. Antiquated methods which mutilate and weaken the belt fibres have been discarded, with other production and time thieving heirlooms. A "Crescent" joining is the modern method of joining belts. An interesting and practical "belt joining" booklet is yours for the asking. Write to the Crescent Belt Fastener Company, 247 Park Avenue, New York.

CRESCENT
BELT FASTENERS

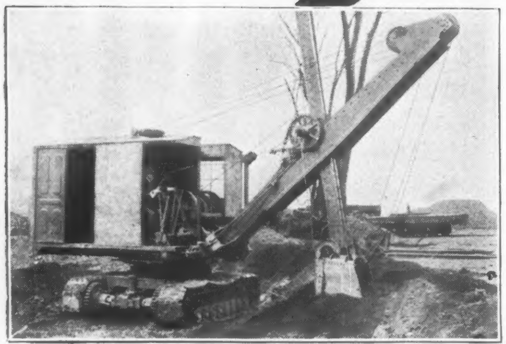
ROAD MAKING or Maintaining

For Every Operation There is a Machine Equipped with

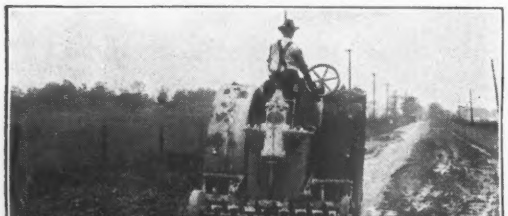
CLIMAX

Trade Mark Reg. U.S. Pat. Off.

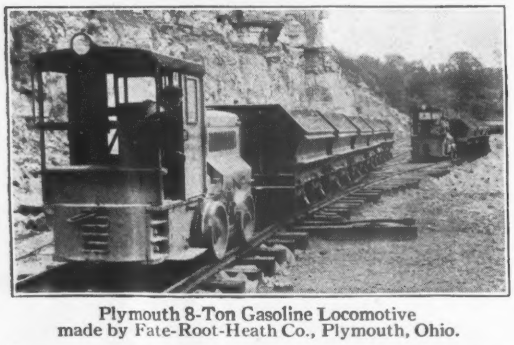
The "Trustworthy" Engine



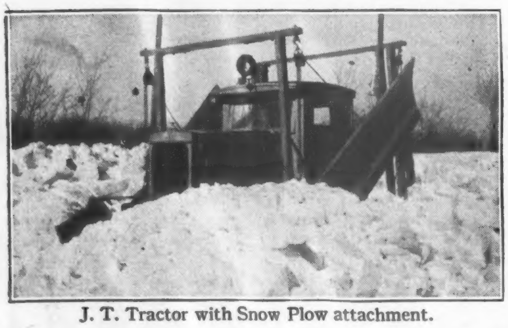
McMyler-Interstate No. 2 Gas Shovel at work on the job.



Tearing up old Macadam Road with Galion 4-cylinder Motor Roller with Scarifier attachment.



Plymouth 8-Ton Gasoline Locomotive made by Fate-Root-Heath Co., Plymouth, Ohio.



J. T. Tractor with Snow Plow attachment.

These reliable manufacturers use Climax "Trustworthy" Engines as Standard Equipment.

Shovels and Cranes

Austin Machinery Corp., Muskegon, Mich.
Bay City Dredge Works, Bay City, Mich.
Brown Hoisting Mach. Co., Cleveland, Ohio
Industrial Works, Bay City, Mich.
Keystone Driller Co., Beaver Falls, Pa.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Company of America, Champaign, Ill.
McMyler-Interstate Co., Cleveland, Ohio
Orton Crane & Shovel Co., Chicago, Ill.
The Russell & Co., Massillon, Ohio

Hoists

Lidgerwood Mfg. Co., New York, N. Y.
O. K. Clutch & Mach. Co., Columbia, Pa.

Tractors

Four Drive Tractor Co., Big Rapids, Mich.
Kennison Mfg. Co., Solomon, Kans.
J. T. Tractor Co., Cleveland, Ohio
Wisconsin Farm Trac. Co., Sauk City, Wis.

Gasoline Locomotives

Davenport Loco. Works, Davenport, Iowa
Fate-Root-Heath Co., Plymouth, Ohio
Mid-West Loco. Works, Cincinnati, Ohio
Milwaukee Loco. Mfg. Co., Milwaukee, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Geo. D. Whitcomb Co., Rochelle, Ill.

Ditchers

Greiman Ditcher Co., Garner, Iowa
Parsons Co., Newton, Iowa

Rollers and Scarifiers

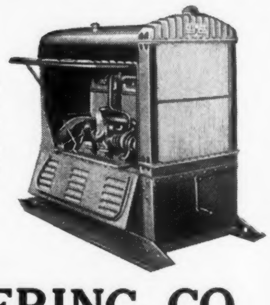
Galion Iron Works & Mfg. Co., Galion, O.

Air Compressors

Mundie Manufacturing Co., Peru, Ill.
Rix Compressed Air & Drill Co., San Francisco, Calif.
Buhl Co., Chicago, Ill.

Also Portable Power Units for Every Purpose

The "Trustworthy" Engines supplied by us to the above list of well-known builders of high-grade machinery, are also available in 17 different types of Portable and Semi-Portable Power Units for every purpose, where from 25 to 140 H. P. is required.



Write for Bulletin E

CLIMAX ENGINEERING CO.

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Cleveland Branch: 657 Leader Bldg., Cleveland, Ohio
Chicago Branch: 2007 Harris Trust Bldg., Chicago, Ill.
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New Orleans. La.: Woodward, Wight & Co., 451 Howard St.
Southwestern Branch: P. J. Dasey, Hotel Wells, Tulsa, Okla.
Los Angeles, Calif.: Coast Machinery Corp.. 464-66 E. 3rd St.
San Francisco, Calif.: Coast Machinery Corp., 829 Folsom St.
Birmingham, Ala.: Keiser-Geismer Engr. Co., 1308-9 American Trust Bldg.
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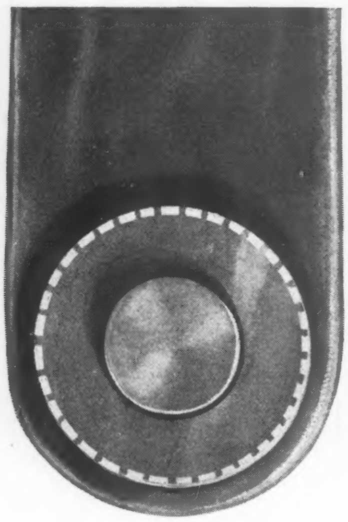
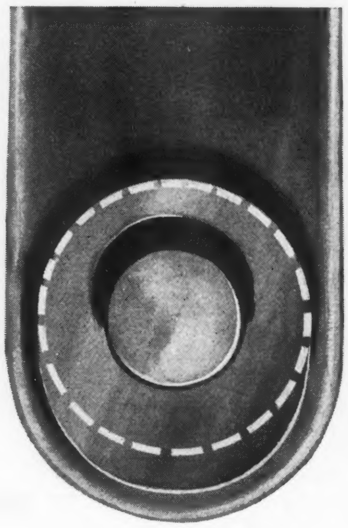
Minneapolis, Minn.: Wm. H. Ziegler Co., 619 Washington Ave. S.
Portland, Ore.: J. L. Latture Equipment Co., 354 Belmont St.
St. Louis, Mo.: Tulley Equipment Co., 2339 Pine Street.
Omaha, Neb.: Interstate Machinery & Supply Co.
Montreal, Que., Can.: Edward C. Dingman. 1005 Keefer Bldg.
Louisville, Ky.: Belnap Hardware Co.

Visit our Exhibit at the National Road Show, Chicago, Jan. 10-14, 1927, Booths W-11 and W-12.

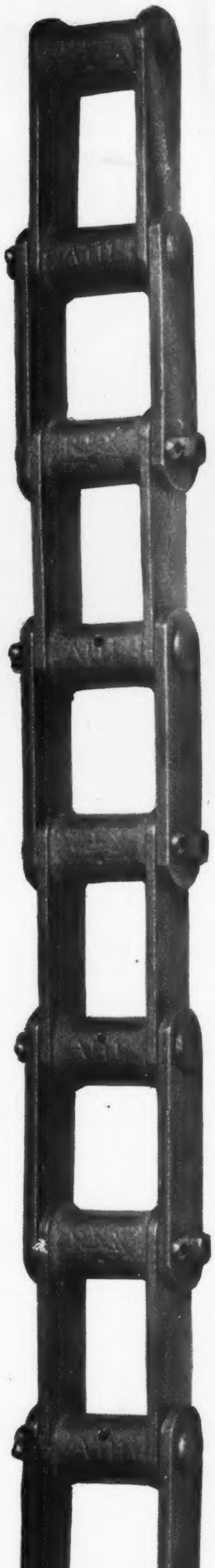
Are Your Chains and Sprockets Grinding Their Life Away?



Old Style Combination Chain



Rex Durobar with the added metal



Due to the added metal section placed off center to the pin, in the barrel of the malleable block link of Rex Durobar, the particular source of bad sprocket action of ordinary combination chain is completely overcome. Only the rear barrel engages with the sprocket tooth. The added metal on this barrel serves to thrust the forward barrel forward *out of contact with the sprocket tooth.* In ordinary combination chains it is the forward barrel that grinds.

Fits Standard Sprockets

Rex Durobar is not a special Chain except in its construction. It fits Standard Sprockets. It retains all of the low cost advantages of ordinary combination chain, plus that great advantage which combination chains can never provide, that is, freedom from bad sprocket action.

The relieved and lubricated barrel

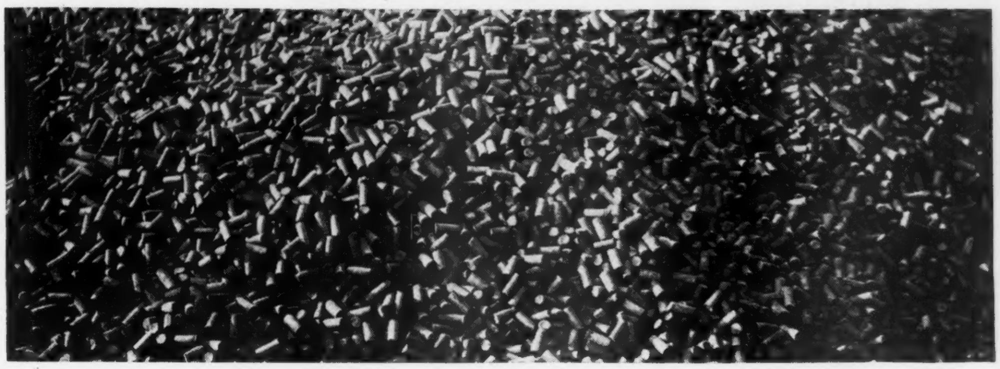
Rex Durobar can be furnished either with or without lubrication. The relieved and lubricated barrel has been found especially desirable for use in handling hot or acidulated materials.

A new folder deals with Rex Durobar. Send for your copy.

REX CHAIN

CHAIN BELT COMPANY, 749 Park Street, Milwaukee, Wisconsin

"TUNGSCO"



Steel Nuggets

The Standard Grinding Media

Be assured of satisfactory and low-cost grinding with the use of "Tungsco" Steel Nuggets. Their consistent performance day-in and day-out in all types of compartment and tube mills has earned for them a "repeat-order" reputation.

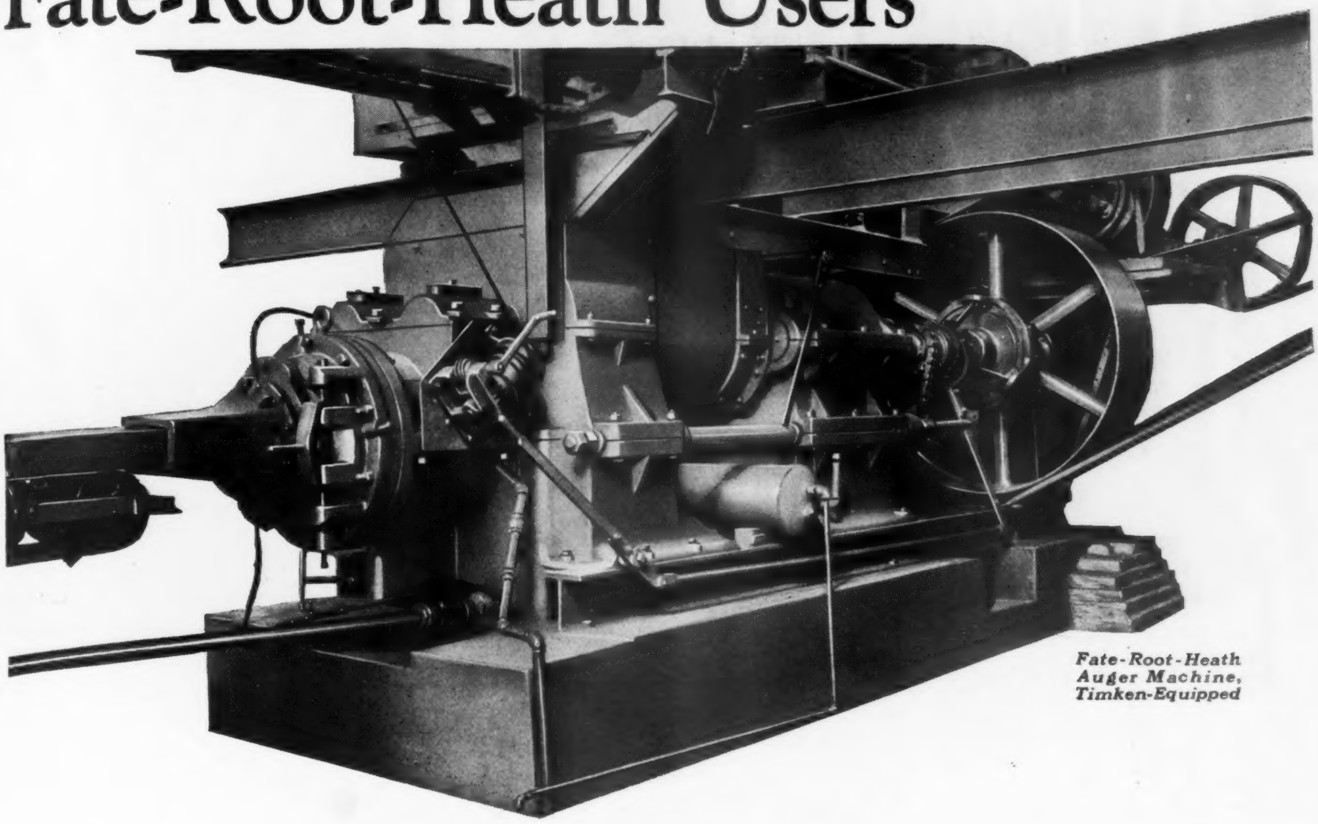
Standard sizes—5/8 x 1-1/4, 3/4 x 1-1/4, 7/8 x 1-1/4, 1 x 1-1/4.

Largest Exclusive Manufacturers of Grinding Media

Coates Steel Products Company

GREENVILLE, ILLINOIS

Timken Values for Fate-Root-Heath Users



Fate-Root-Heath Auger Machine, Timken-Equipped

The Fate-Root-Heath line has a fine reputation to sustain in an industry so strenuous that only the best stands up at all. Traditions of engineering excellence and operating economy are entrusted to the performance of Timken Tapered Roller Bearings in the Fate Auger machine.

Here Timken Taper, Timken *POSITIVELY ALIGNED ROLLS,* and Timken-made electric steel provide the indispensable high load capacity. The heavy thrust reactions, in particular, give Timken Bearings an opportunity to demonstrate their anti-friction properties, and their matchless endurance, under the most severe operating conditions.

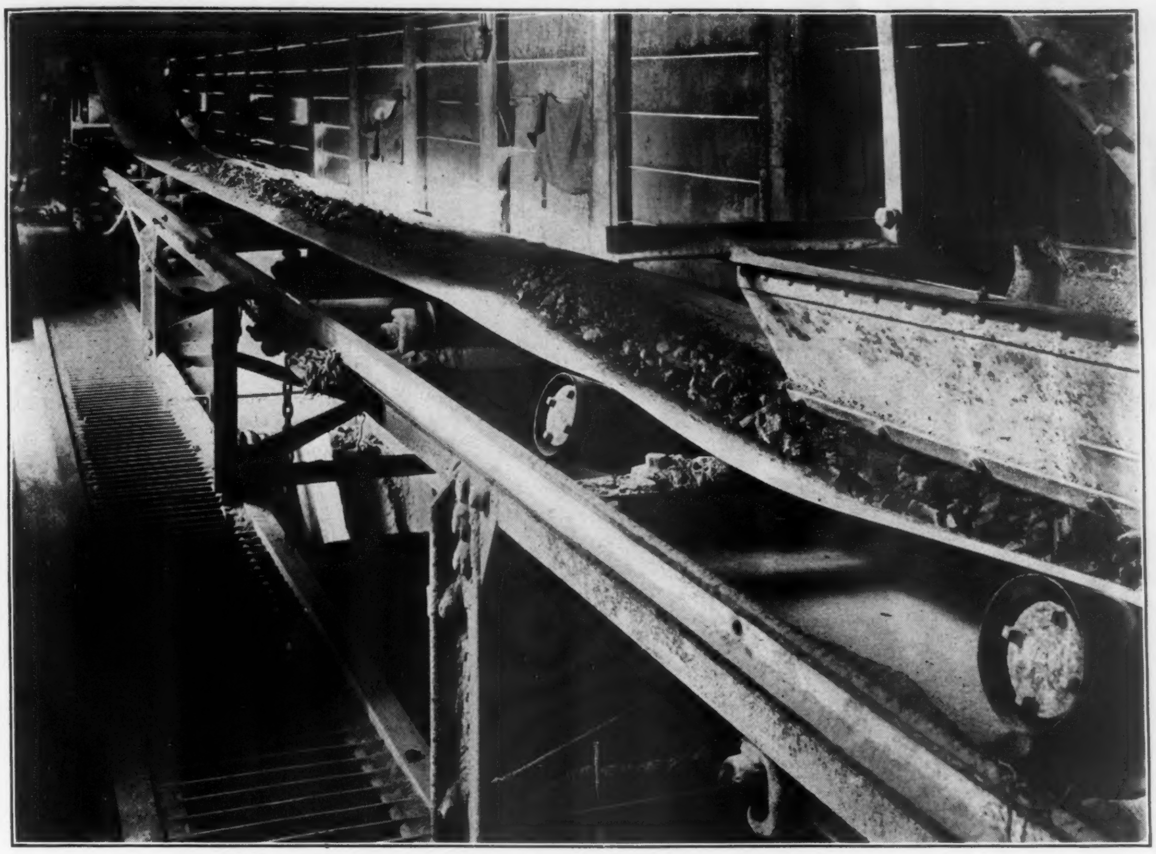
These bearings are capable of reducing power requirements one-third, and they also save power units and belts by easing the starting load. These bearings run for months without renewed lubrication, and they run without any other attention for such extended periods that the whole ceramics industry is obtaining a new idea of bearing durability.

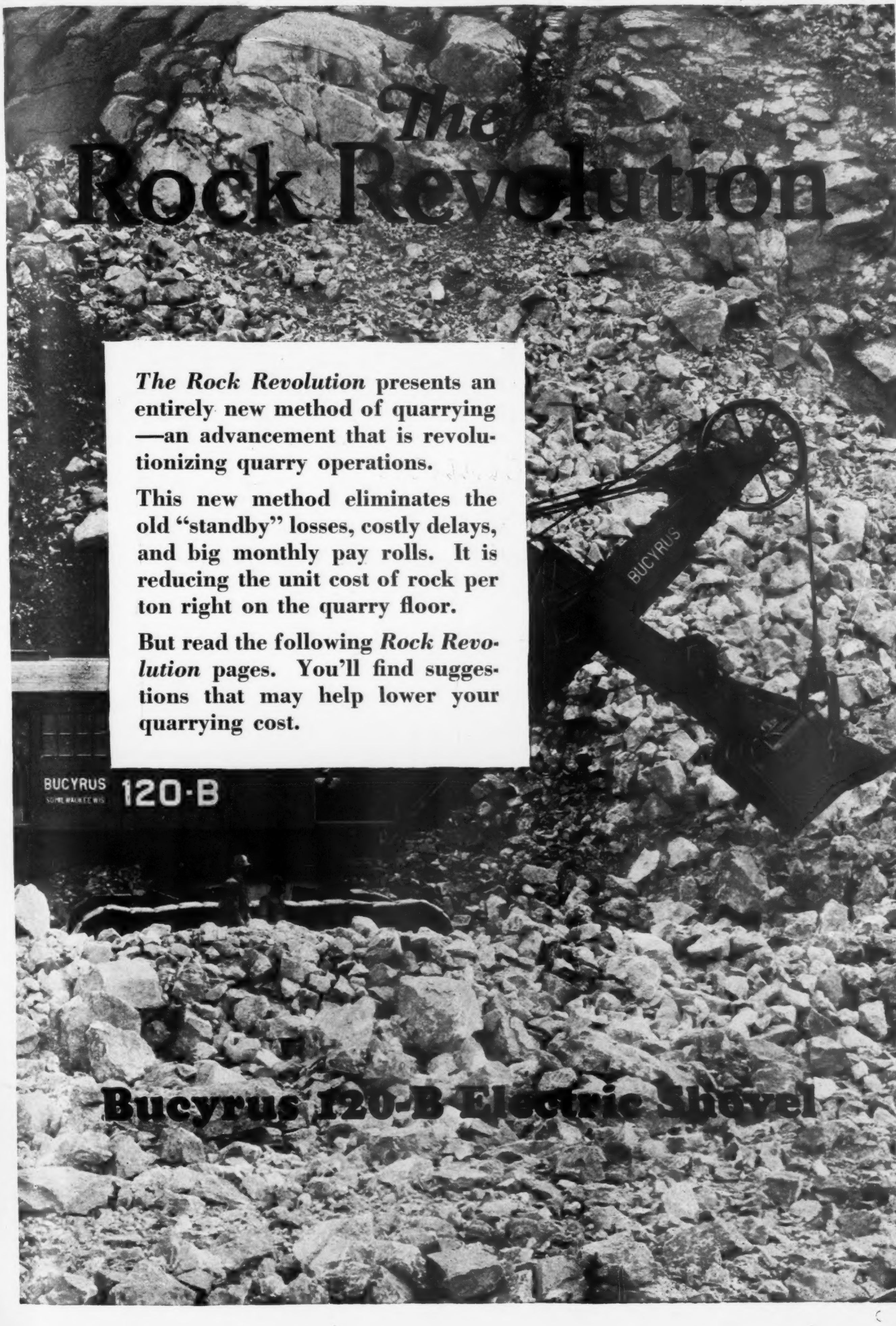
Those are the assurances Timkens always add to the assurance of a great maker's name.

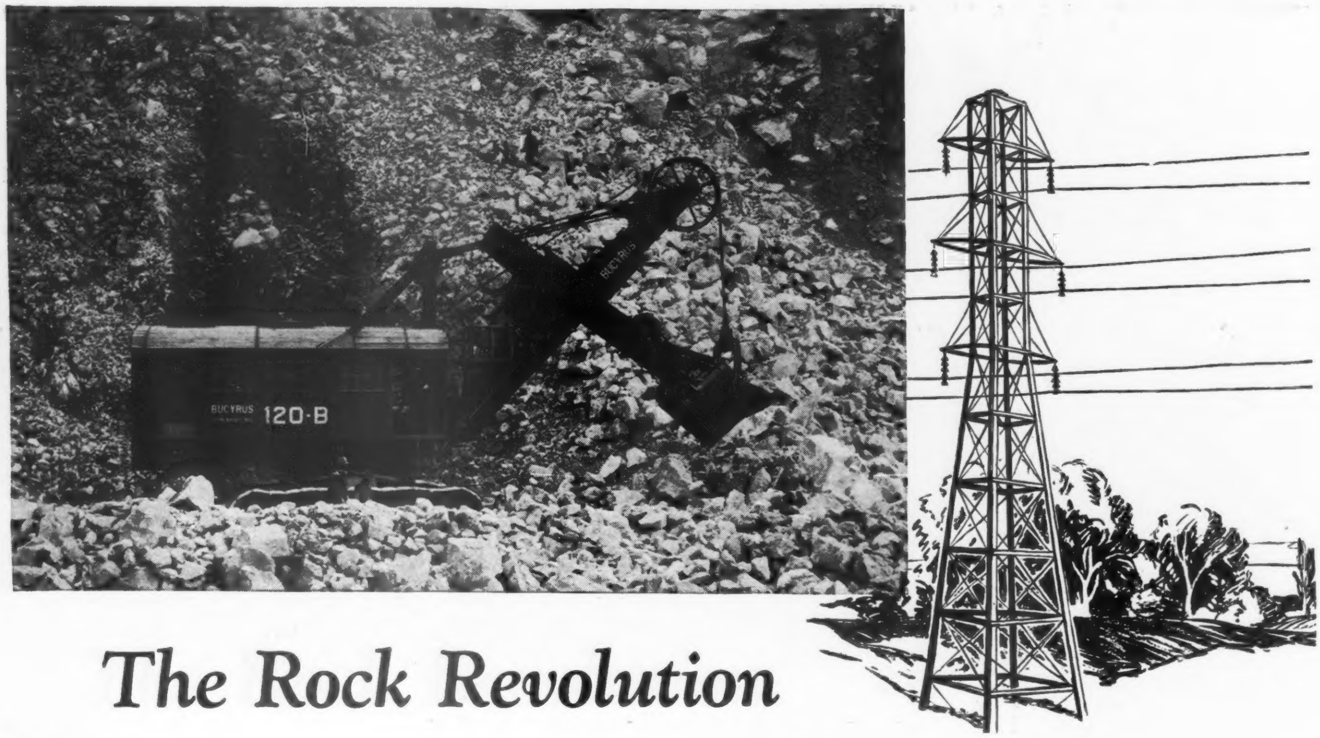
THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

Technical information regarding bearing sizes and their mountings can be secured from the Timken Roller Bearing Service & Sales Company's Branches located in the following cities: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, Newark, New York, Omaha, Philadelphia, Pittsburgh, Richmond, St. Louis, San Francisco, Seattle, Toronto, Winnipeg

TIMKEN *Tapered Roller* **BEARINGS**




The
Rock Revolution
The Rock Revolution presents an entirely new method of quarrying —an advancement that is revolutionizing quarry operations.
This new method eliminates the old "standby" losses, costly delays, and big monthly pay rolls. It is reducing the unit cost of rock per ton right on the quarry floor.
But read the following *Rock Revolution* pages. You'll find suggestions that may help lower your quarrying cost.
BUCYRUS
BUCYRUS 120-B
Bucyrus 120-B Electric Shovel



The Rock Revolution

Goodbye Coal and Water Expense

The Bucyrus 120-B Electric Shovel is showing marked savings—lowers tonnage costs

In Mine and Quarry Work

The constantly increasing use of electric power and the resulting cross country high tension lines now make electricity economically available to most mines and quarries.

The 120-B Electric Shovel, drawing power from these lines, is showing a marked swing toward extremely lower tonnage costs in quarrying and open pit mining.

It eliminates the old "stand-by" losses. There is no steam to keep up during waiting periods.

Water and boiler troubles, coal buying and hauling, and the griefs of frozen pipe lines are all done away with.

The 120-B Electric also eliminates the services of a night watchman or fire tender. On the coldest morning, all the operator has to do is throw the switch and this shovel is ready for action.

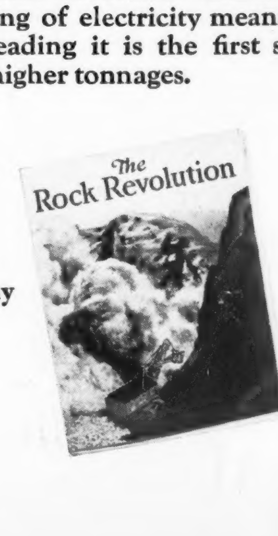
And with the 4-yard dipper backed by more than enough power to fill it at every pass, the 120-B can increase your yardage per hour—can bring the digging cost per ton still lower.

The Bucyrus 120-B is the only 4-yard electric shovel on the market that combines the digging ability of the railroad type machine with the full revolving swing and the mobility of smaller shovels.

Our new booklet, the *Rock Revolution* illustrates in detail what the coming of electricity means to mines and quarries. Reading it is the first step toward lower costs and higher tonnages.

A Postcard brings our Series P. Booklet

Send the card Today



BUCYRUS COMPANY, SOUTH MILWAUKEE, WISCONSIN

BUCYRUS

718

NEW YORK CHICAGO BIRMINGHAM SAN FRANCISCO PITTSBURGH TOKYO LONDON

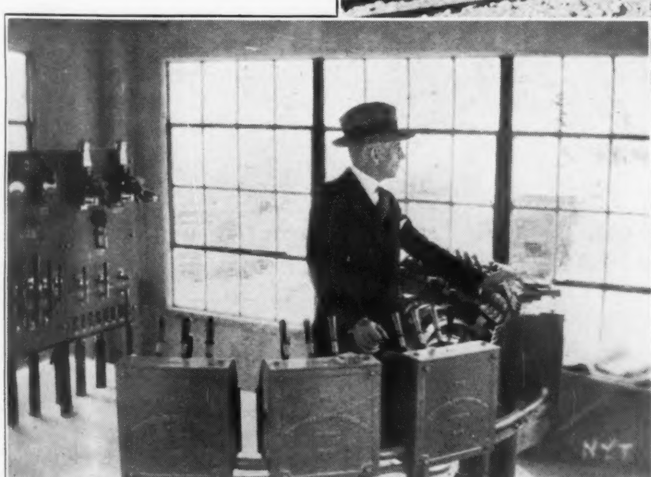
THE ROCK REVOLUTION

In Mine and Quarry

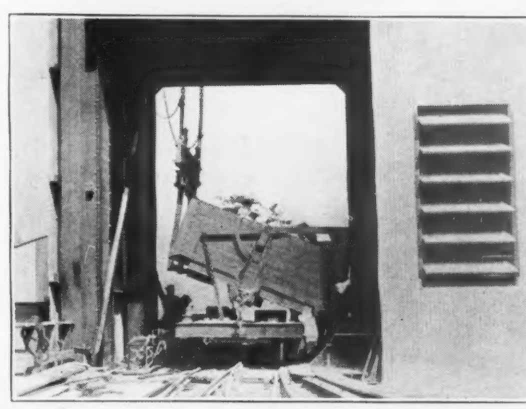
Woodford Haulage Systems

Are Serving Efficiently

The Cars That Run Themselves
Standard Gauge Electric Powered
Serving the Shovels Continuously
Feeding the Crusher Uniformly
Most Efficient in Power
Greatest Saving in Labor
Dumping Themselves

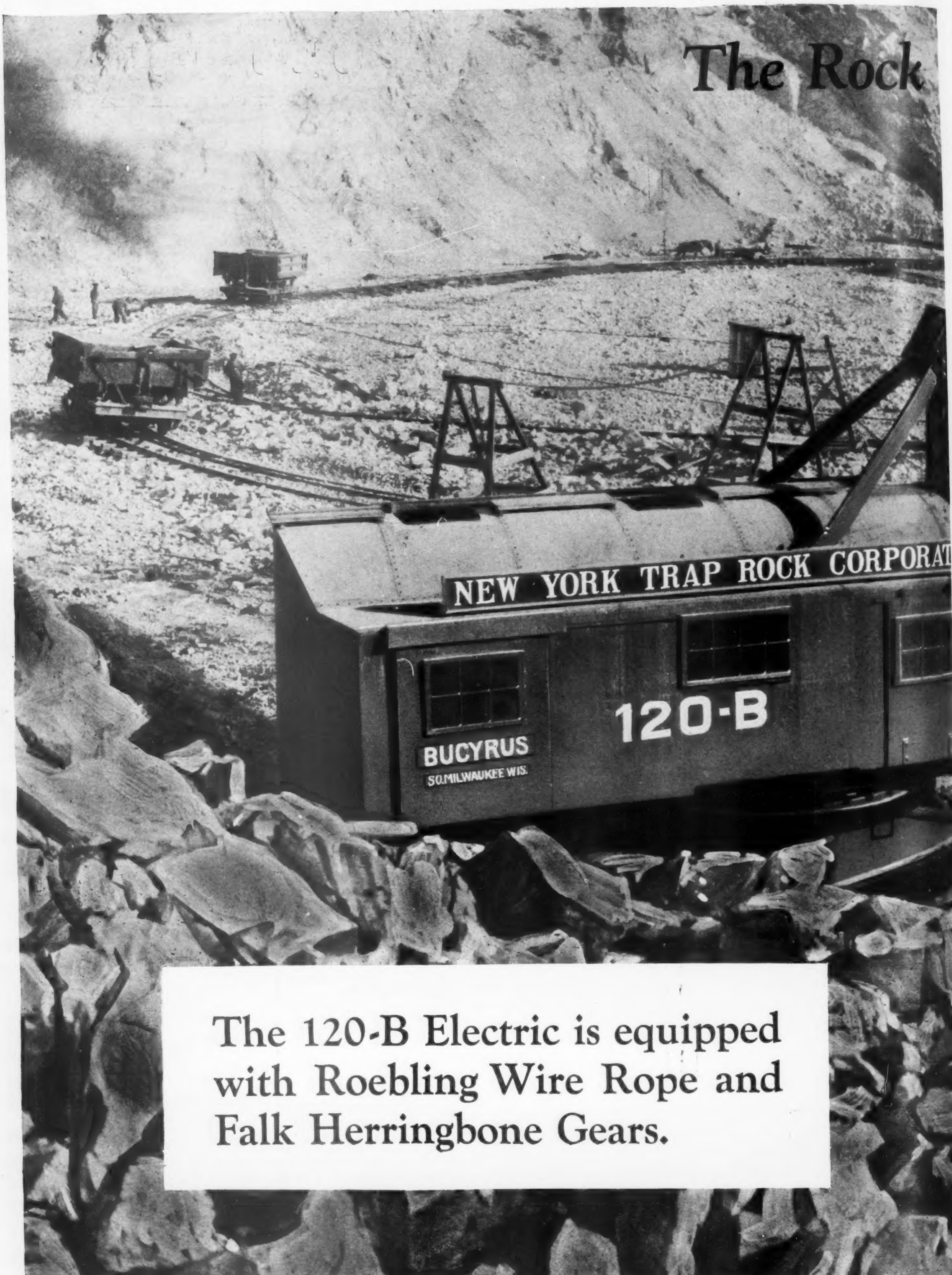


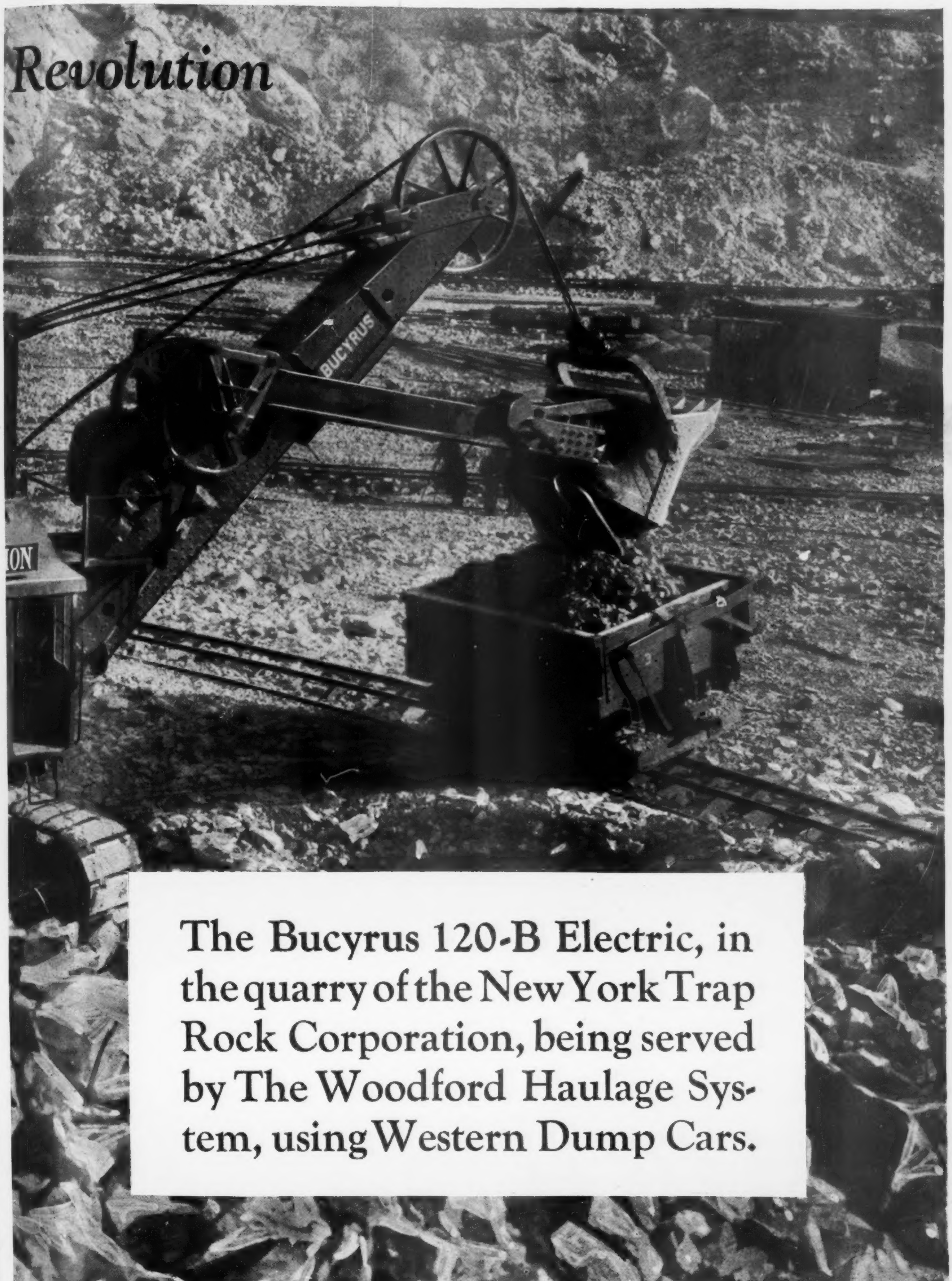
From the Control Tower
One Man Controls
All Car Operations



THE WOODFORD ENGINEERING COMPANY
77 West Washington Street, Chicago, Ill.

WOODFORD HAULAGE SYSTEM


The Rock
NEW YORK TRAP ROCK CORPORAT
120-B
BUCYRUS
SO. MILWAUKEE WIS.
The 120-B Electric is equipped with Roebling Wire Rope and Falk Herringbone Gears.


Revolution
BUCYRUS
The Bucyrus 120-B Electric, in the quarry of the New York Trap Rock Corporation, being served by The Woodford Haulage System, using Western Dump Cars.

Western 10-yard Quarry Car—This is the type used by the Woodford Engineering Company for electrically operated installations.

Built for Heavy Rock

When the Woodford Engineering Company wanted a quarry car for operation by the Woodford system—a car that stands up under the pounding of rock and delivers the goods—we built the car shown above.

This is a special car built with steel underframes and with automatic or a link and pin coupler, electrically driven and controlled from a central tower and spotted and dumped at the crusher by outside electrical control. This type of car has been installed by various companies. Ask them how it is delivering the goods.

The adaptability of the general Western design to almost any haulage situation accounts for the widespread installation of Western Dump Cars in the pits and quarries of the country.

For stripping purposes the sturdy Westerns cannot be excelled. The size of car depends on your local conditions. The type should be Western if you want a car that will give long service at low maintenance cost and will have a high resale value when you desire a larger installation.

Strength and endurance are expressed in every line of its construction. The bed floor is of 5-inch oak. The weight of the car is 27,000 pounds.

We will gladly send complete information. Write today.

1877 Western 1927

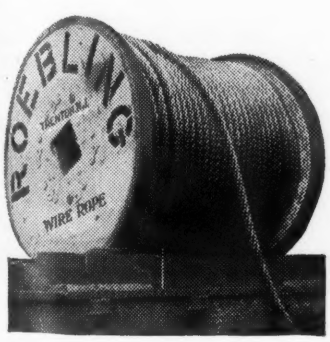
Western Wheeled Scraper Company

Builders of Dump Cars and Earth and Stone Handling Equipment

AURORA, ILLINOIS

For heavy-duty hoisting

Roebling Blue Center Steel Wire Rope is part of the standard equipment of Bucyrus Shovels and Draglines. It is made of a superior grade of steel produced in our own furnaces, and is furnished in constructions of proven fitness for dredges and excavating machinery. It will withstand the sudden pulls, and abrasions to which ropes are subjected in excavating work.



John A. Roebling's Sons Company, Trenton, N. J.

Makers of Wire Rope and Wire

Roebling


FALK
Gears and Couplings on Bucyrus Equipment
Shovels, excavators and dredges operate under tremendous strain. Every part must be built to stand the strain of scooping in banks of hard clay and piles of hard rock. Tremendous load—maximum speed demand more than average service. This is why Falk Herringbone Gears and Falk Flexible Couplings are used—they stand the strain, transmitting the loads under the most gruelling conditions, giving the utmost in service and protecting the machinery from shock.
THE FALK CORPORATION
Milwaukee, Wisconsin
BUCYRUS
NORTH AMERICAN
CORPORATION
100-B
BUCYRUS

2 points

of practical interest for you to visit while you are in Cincinnati during the meeting of the National Sand and Gravel Association, January 17, 18 and 19, 1927.

1.—The home of the Cincinnati Rubber Mfg. Co., where the best of conveyor and transmission belts, sand suction hose and dredge sleeves are manufactured.

2.—The plant of the Ohio Gravel Ballast Co., where you can see the results which Cincinnati-made belts are giving in handling sand and gravel and in transmission service

[***We'll be mighty glad to see you in Cincinnati***]

The Cincinnati Rubber Mfg. Co.

TWENTY-TWO YEARS OF QUALITY PRODUCTION

Make a Note of This

You are invited to visit the plant of

The Ideal Concrete Machinery Co.

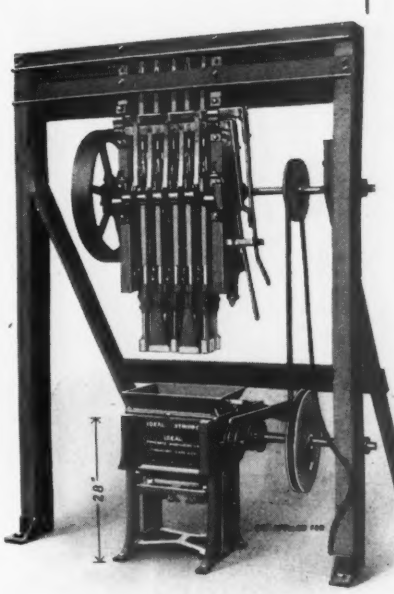
and to take advantage of the many courtesies we shall offer during the

National Sand and Gravel Assn. Convention

which meets in Cincinnati
January 18 and 19, 1927

Be sure to visit the home of the famous

Ideal Vertical Stripper



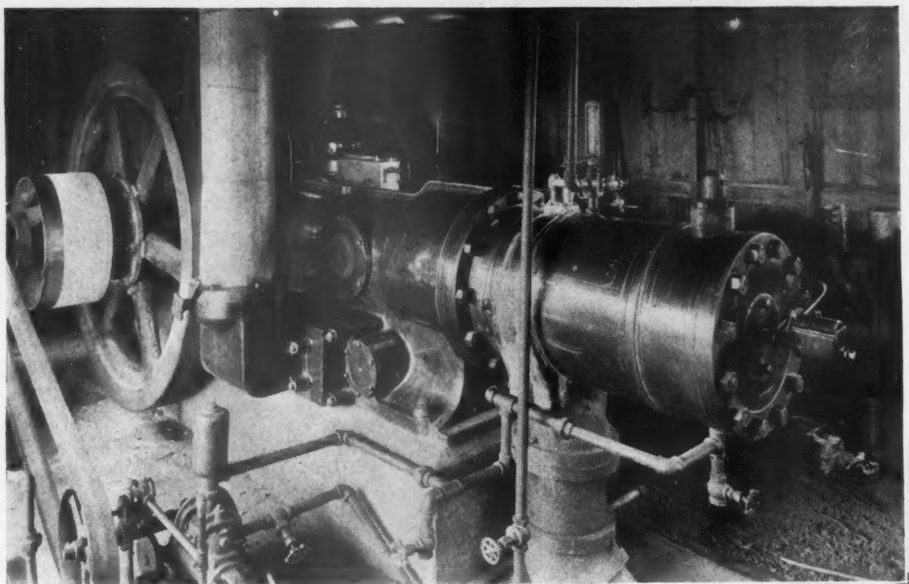
When you see how carefully it is made, you will have even greater respect for its prowess and performance. Meantime, plan to keep your Stripper on the job all Winter—it is built for "any-old-kind-of-weather" work, and there is plenty of work to do, too.

Winter operation means distribution of overhead costs; maintenance of the gang; and an opportunity of making up stock against early Spring demand. The Ideal Vertical Stripper fills the bill admirably: producing A-No. 1 Block and Tile . . . strips with power at no additional cost . . . offers low and convenient off-bearing height . . . big production . . . thorough tamping with the Ideal 10-Bar Tamper.

We will also show you model concrete products plants. There are some beauties right near us. You'll enjoy the ride—you'll profit by a visit to the plants.

IDEAL

THE IDEAL CONCRETE MACHINERY CO.
5000 SPRING GROVE AVE. CINCINNATI, OHIO
TRADE MARK IDEAL REG. U.S. PAT. OFF.



75 H.P. PRIMM Oil Engine at the Rockport Stone Quarry

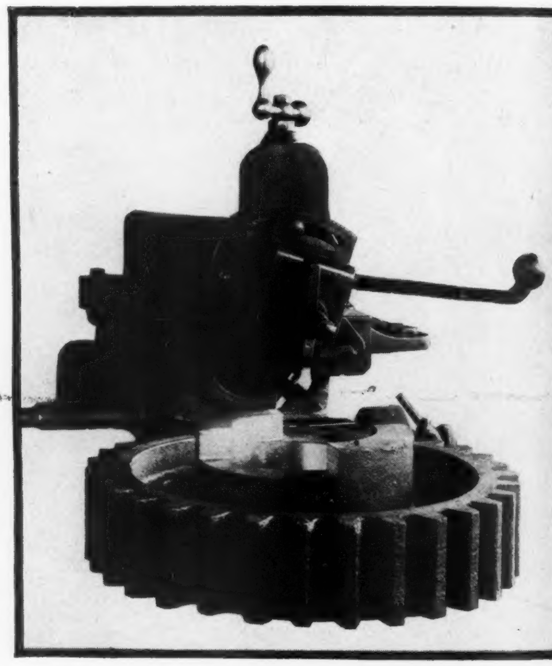
FARRELL'S 85

Write us for quotations and recommendations on different types of castings to which this excellent wear-resisting material is applicable. Any information you may have to offer as to the weights of castings and requirements will be greatly appreciated. Send us your prints or sketches.

On application we will be more than pleased to send literature and physical characteristics of "Farrell's 85."

A Distinct Advantage

Farrell's 85 offers an advantage to the engineer who strives to eliminate breakages and consequent shutdowns and delays in a plant. The fact that this material is machinable during the process of manufacture lends to it a greater scope of adaptability and permits instituting a greater percentage of strength and wear resistance to many parts whose tolerances prevent their being made in unmachinable alloys. Castings may be received that are machined to the closest limits, insuring true mechanical performance, and possess a hardness and toughness equal to many unmachinable alloys.



Farrell's 85 contributes maximum strength to an installation and due to its great ductility reduces breakages to a minimum. It will not batter nor flow after being subjected to repeated shocks.

SEE OUR EXHIBIT AT THE ANNUAL GOOD ROADS SHOW IN CHICAGO, JANUARY 10TH TO 14TH INCLUSIVE

The Farrell-Cheek Steel Foundry Co. Sandusky, O.

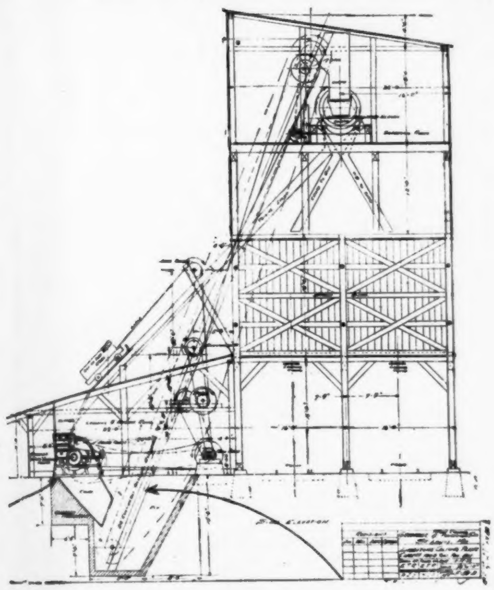
FARRELL-CHEEK

F.C. F.C.

Head and shoulder above them all

Gruendler all-steel Swing Hammer Crushers for Primary, Secondary or Pulverizing, or all three combined. No greater reduction has ever been obtained on any other equipment with so little power, low upkeep, and most uniform product.

We can recommend a 72-inch all-steel Gruendler for 48 to 1 reduction, 50-inch all-steel Gruendler 36 inch to 1 reduction, 42-inch all-steel Gruendler, 24 to 1 reduction. For secondary crushing of 8 and 10-inch to ¾-inch for cement plant, the G ruendler cannot be equaled. Over 200,000 tons have been delivered through crushers before making renewals of hammers and grate bars. Dependable and continuous service can be expected at all times. Illustration shows cross section of our principal with Trap Iron Catcher equipped with heavy roller or ring oiling bearings. Illustrated cross section 1000-ton Crushing Plant using only one Crusher, the Hammer Type, one complete sizing screen and elevator.



Plants of this type cost one-half to build, more economical to operate, turn out a more uniform product and are more profitable. Have representatives in all principal cities in United States and foreign countries. Let us have salesman call. Write for our latest catalogue on Rock and Gravel Screening Equipment.

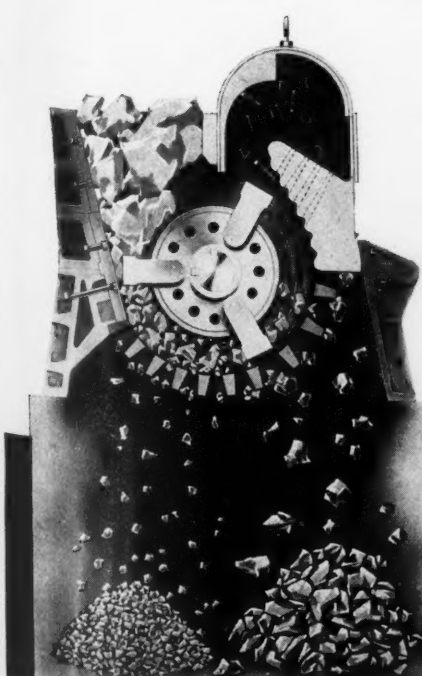
GRUENDLER PATENT CRUSHER & PULVERIZER CO.

First and Franklin Avenue

ST. LOUIS MISSOURI

Below: Cross section of hammer crusher showing different sizes of material that can be made on one machine, also showing Positive Tramp Iron Catcher.

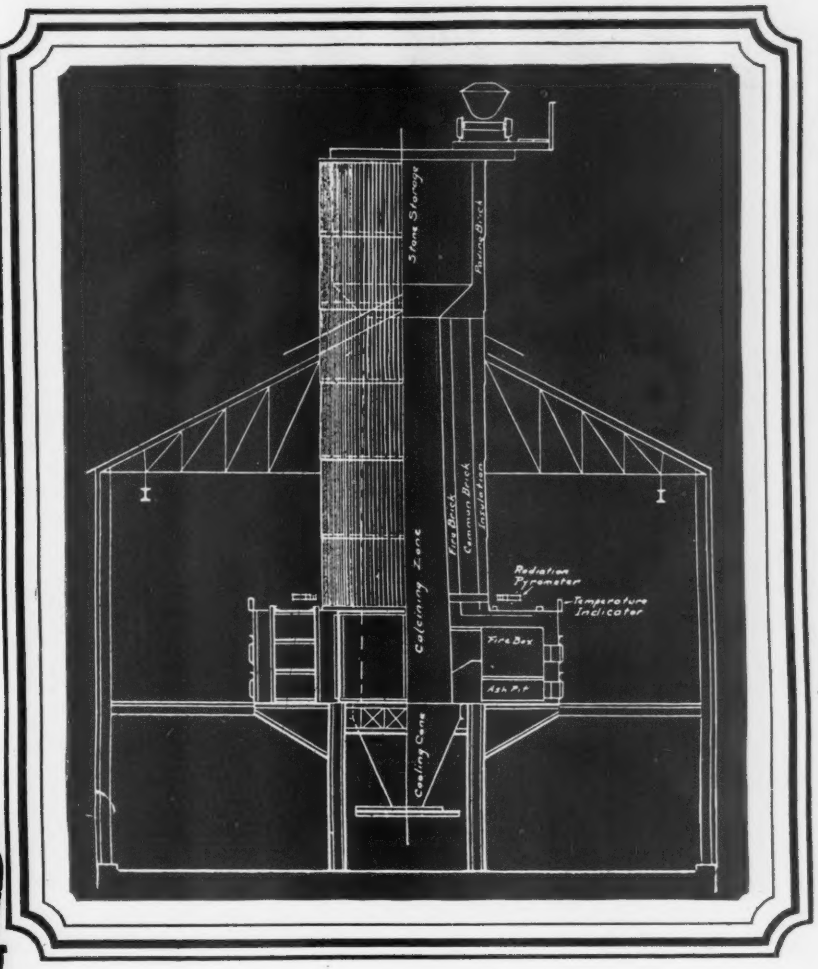
Right: New Secondary Crusher for Dewey Portland Cement Co.



profit by this service

THE reputation of Miscampbell Engineering Service is as far-reaching as the lime industry itself. We maintain a staff of engineers thoroughly competent in designing and building a complete lime plant or any part of it. Ours is a complete service, through which the various working units can be arranged and co-ordinated into one great flexible machine.

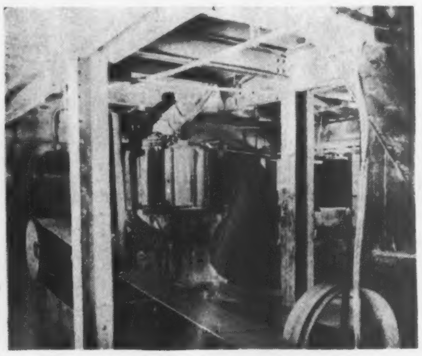
We know lime, know how to manufacture it and can give the benefit of broad technical knowledge to all practical lime problems.

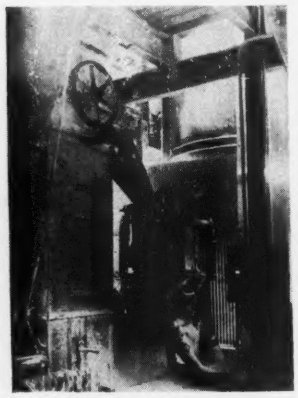


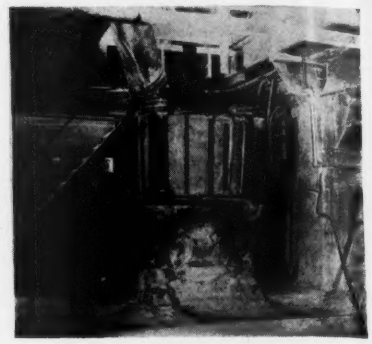
Clyde Kilns are the result of 20 years' experience in close contact with the lime industry. In them are incorporated the best features of the kilns we have worked on in our engineering service at many plants. No guesswork about a Miscampbell Kiln!

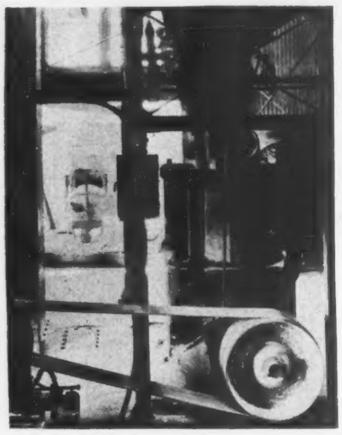
MPBELL

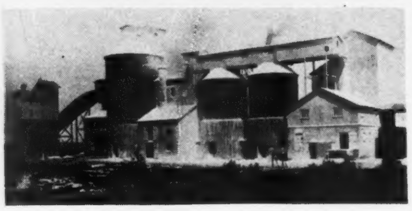
MINNESOTA

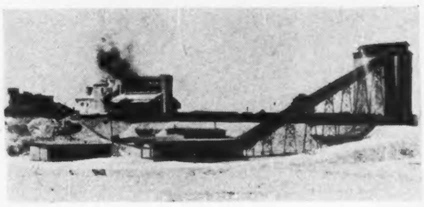


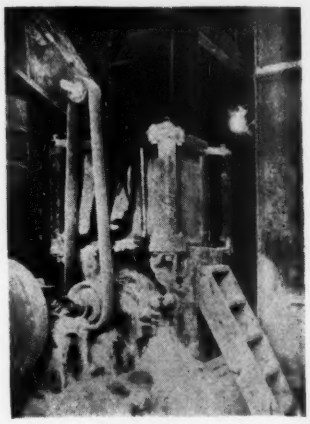


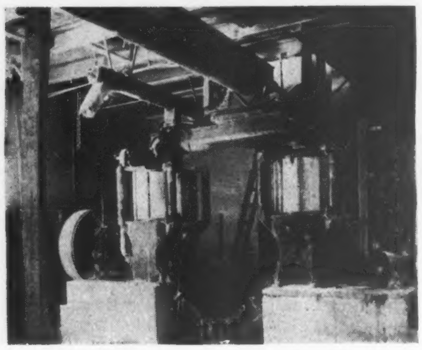


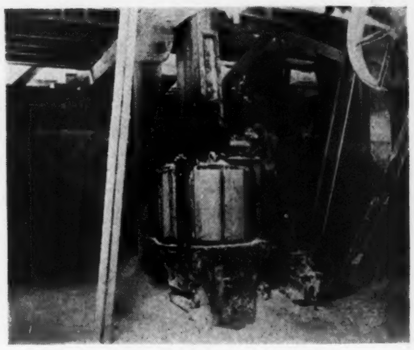












TYPICAL INSTALLATIONS

of Bonnot Pulverizers grinding hydrate lime

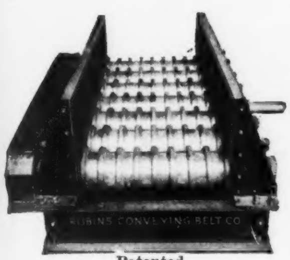
The lime plants of the Woodville district, shown above, endorse the Bonnot Pulverizer because it delivers a finished product of superior quality. That is the report concerning this machine's efficiency which comes from both the lime manufacturers and the masons who use the lime.

Repeated orders from prominent lime producers demonstrate the desirability of the Bonnot Pulverizer for grinding hydrate lime. It is a compact, dependable unit, featured by the ready accessibility of grinding parts for inspection. Write us for complete details concerning this efficient Bonnot unit.

The Bonnot Company

CANTON, OHIO.

Robins helped put it over



Patented
CATARACT GRIZZLY

THE Haverstraw plant of the Tomkins Cove Stone Company is a great engineering achievement.

One of its outstanding features is the ingenious and extensive use of conveyors.

Robins Roller Bearing idlers form the backbone of this remarkable, efficient conveyor system.

THE CATARACT GRIZZLY, the original LIVE ROLL SCREEN for large size screening.

The outstanding features of this grizzly are contained in Bulletin No. 60.

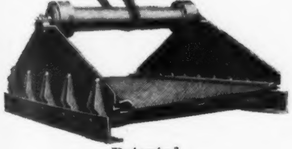
THE SAVAGE SCREEN for medium size material.

Write for information.

THE VIBREX SCREEN for fine separation of crushed rock, ore, sand, gravel, silica, slag and similar materials.—Bulletin No. 67.

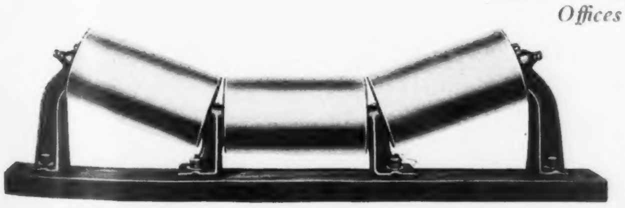
ROBINS EQUIPMENT AND ENGINEERING EXPERIENCE are recognized as vital factors making for plant efficiency.—Catalog No. 65.

See our exhibit at the Crushed Stone Convention. Booths 36 and 37



Patented
VIBREX SCREEN

ROBINS CONVEYING BELT CO.
NEW YORK CHICAGO
Offices and Agents in Principal Cities



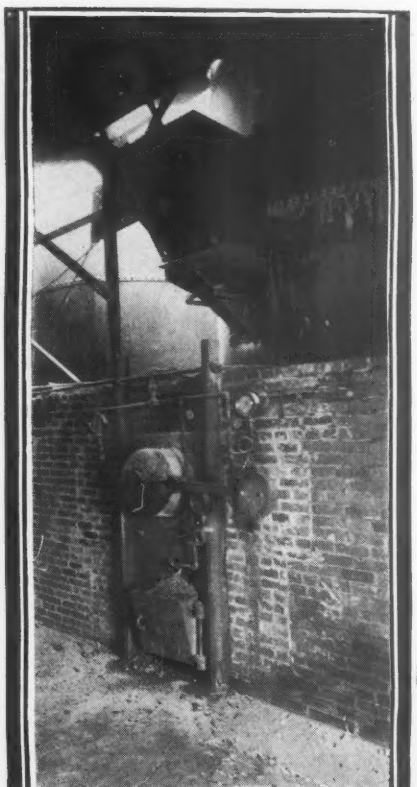
Conveyors and Elevators
Screens and Feeders
Gates, etc.

ROBINS CONVEYING BELT CO.,
15 Park Row, New York City.
I am interested in cutting the costs of our conveying and screening operations. Please send information about
[ ] Idlers
[ ] The Cataract Grizzly
[ ] The Savage Screen
[ ] The Vibrex Screen
Name..........
Firm..........
Address..........

MATERIAL HANDLING
ROBINS
EQUIPMENT

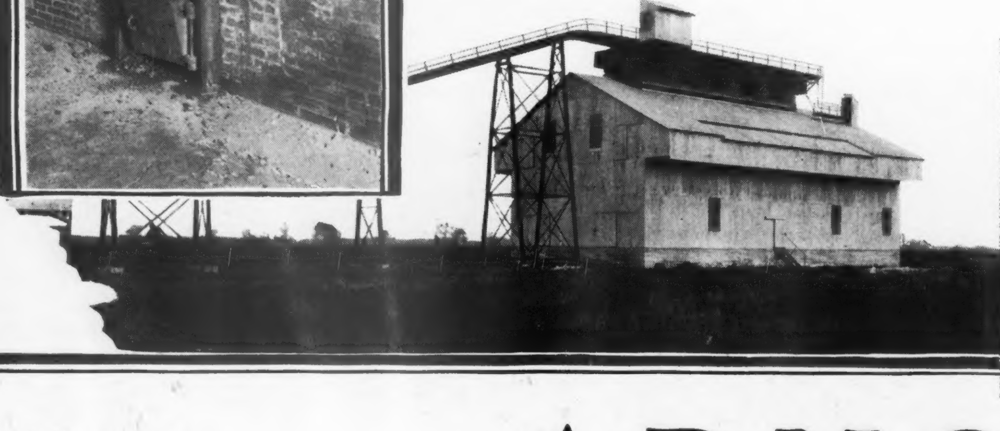
A Complete

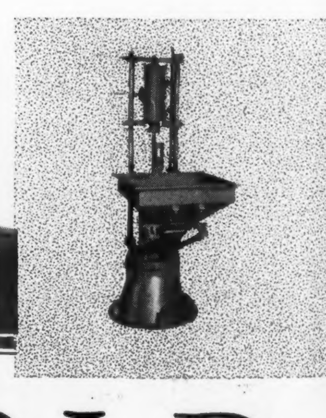
A Typical Stoker Installation
(Brick Front Kilns)



"Centralized Control," the plant building service we render, needs no introduction to the members of the lime industry. The notably successful plants built by the Arnold & Weigel Lime Plant Service are sufficient testimonial to the worth of a lime-plant service where all responsibility, from the drawing-up of the blue prints to the actual first operating of the finished plant, is placed on one skilled and experienced organization.

Nothing is left to chance, there is no possibility of "passing the buck" when things go wrong, if the Arnold & Weigel Engineering Staff is given the complete responsibility from first to last. That's why this service is so popular!





ARNOLD

WOODVILLE **Contractors**

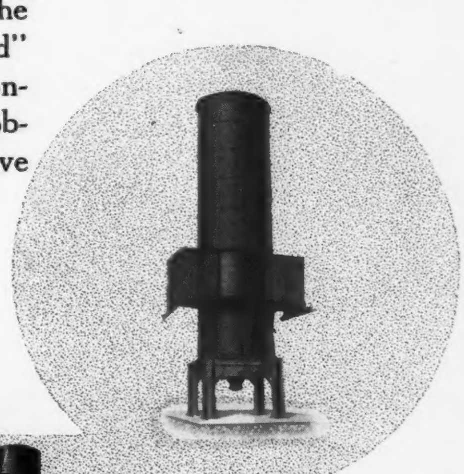
and Specialized LIME SERVICE

Situated in Woodville, our organization enjoys the advantage of intimate contact with a great number of the progressive lime producers of this country.

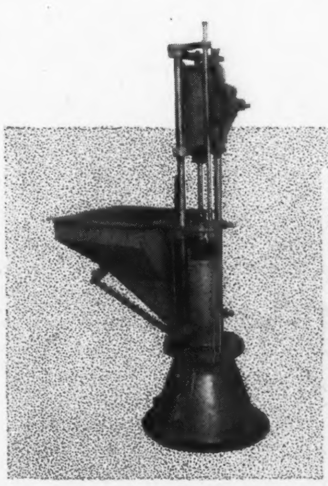
We have "a finger on the pulse" of the lime industry, and are able not only to meet, but even to anticipate, the lime producer's problems.

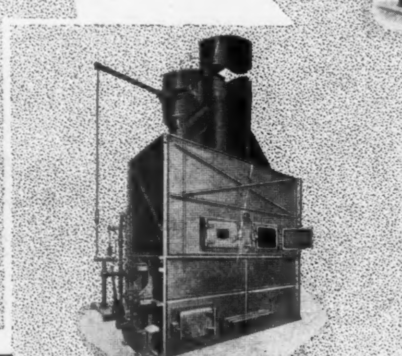
All Arnold & Weigel Equipment, and Service, is characterized by complete practicability. Put your needs up to our Engineers and you need have no worry about the result. From the installation of "Arnold" Kilns, "Ward" Stokers and "Weber" Hydrators to the design and construction of complete modern lime plants, in small problems or big ones, our engineers are ready, and able, to give you the last word in expert service.

The "Arnold" Kiln, designed, built and installed with this one thought uppermost: economy is the dominant present need of the lime industry. Its popularity is universal.



Ward Automatic Coal Stokers give better fuel ratio, more tonnage and uniform quality of lime.



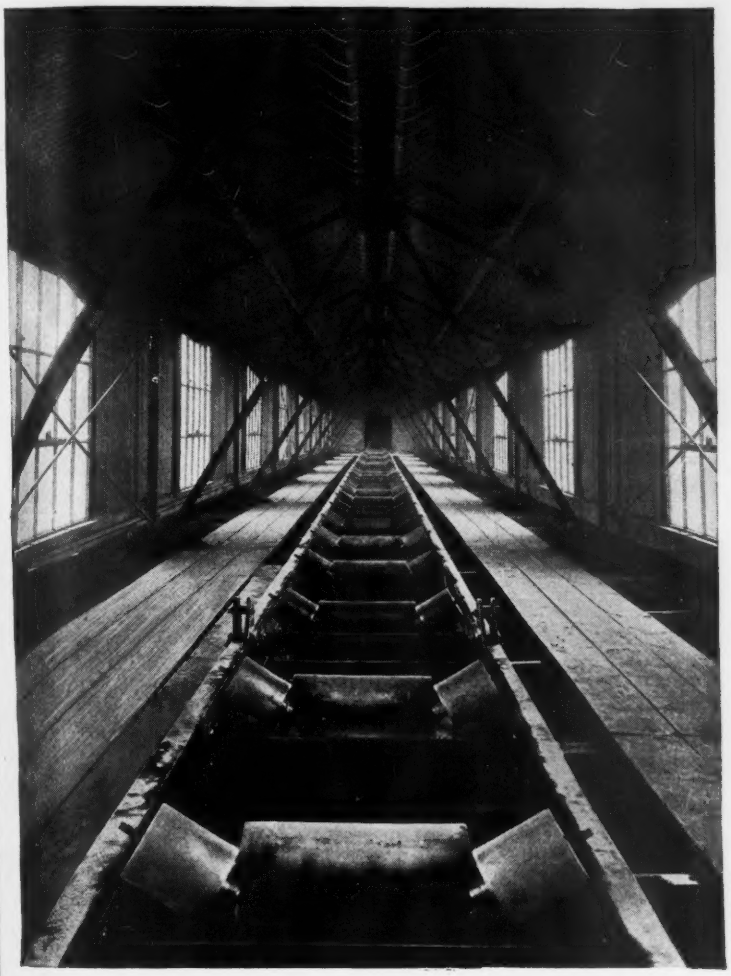


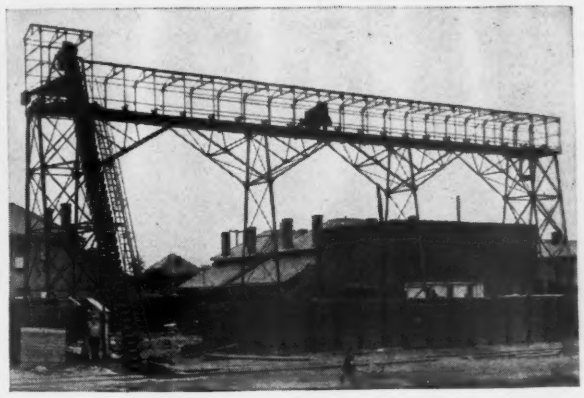
The "Weber" Hydrator, a machine of unrivaled simplicity, featured by compactness, accessibility, thorough mix, and large capacity.

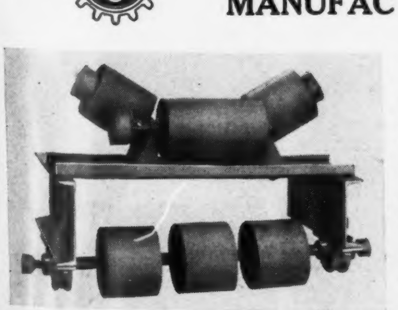
and WEIGEL

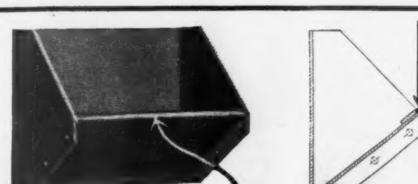
and Engineers

OHIO









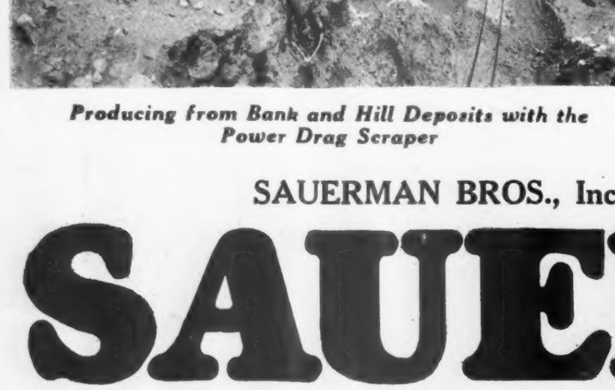
Let Sauerman Show You the Way to Lower Producing and Storing Costs

Excavating Sand and Gravel from Deep and Underwater Pits

WHERE sand and gravel deposits lie under water or in deep pits, the Sauerman Slackline Cableway provides a fast, efficient and low cost method of production.

The Sauerman Cableway does the work of three machines—all in one continuous operation. It ***digs*** successfully in dry ground and under water. It ***conveys*** material over distances of from 200 to 1200 feet. It ***elevates*** the material to the desired height of hopper or screens. ***And it is operated by one man.***

As a result, Sauerman Slackline Cableways are serving to lower the cost of production in plants of many sizes. Send for a copy of "Excavating for Profit." It may show you how to lower your costs, too.

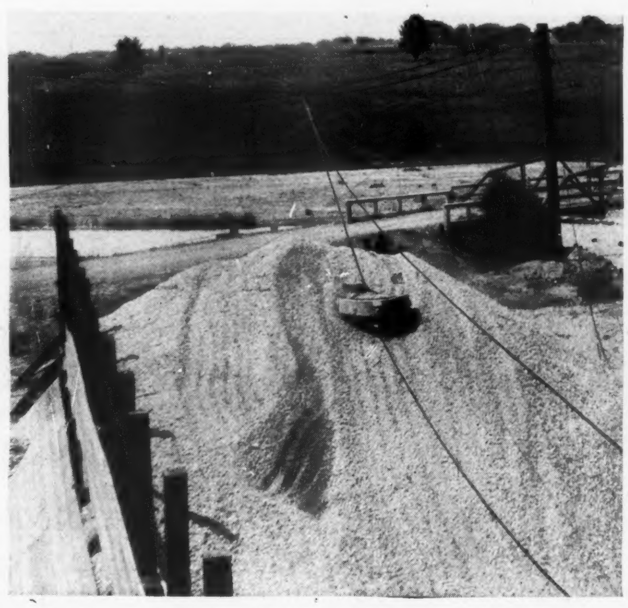


Producing from Bank and Hill Deposits with the Power Drag Scraper

The Sauerman Power Drag Scraper can be used to best advantage in shallow dry pits and bank and hill deposits, though it is suited also to excavating material from ponds and streams.

This fast-working outfit is also operated by one man. It digs sand and gravel from the deposit and conveys it to the plant. It operates over both short and long spans and has a widely varying capacity—depending on the size of bucket used. Power requirements are small. Operating costs are low.

Because of these things, Sauerman Power Drag Scraper users can produce sand and gravel at exceptionally low costs. Our Pamphlet No. 24 will show you how they do it. Send for your copy today.



A Cheaper, Easier Method of Storing and Reclaiming

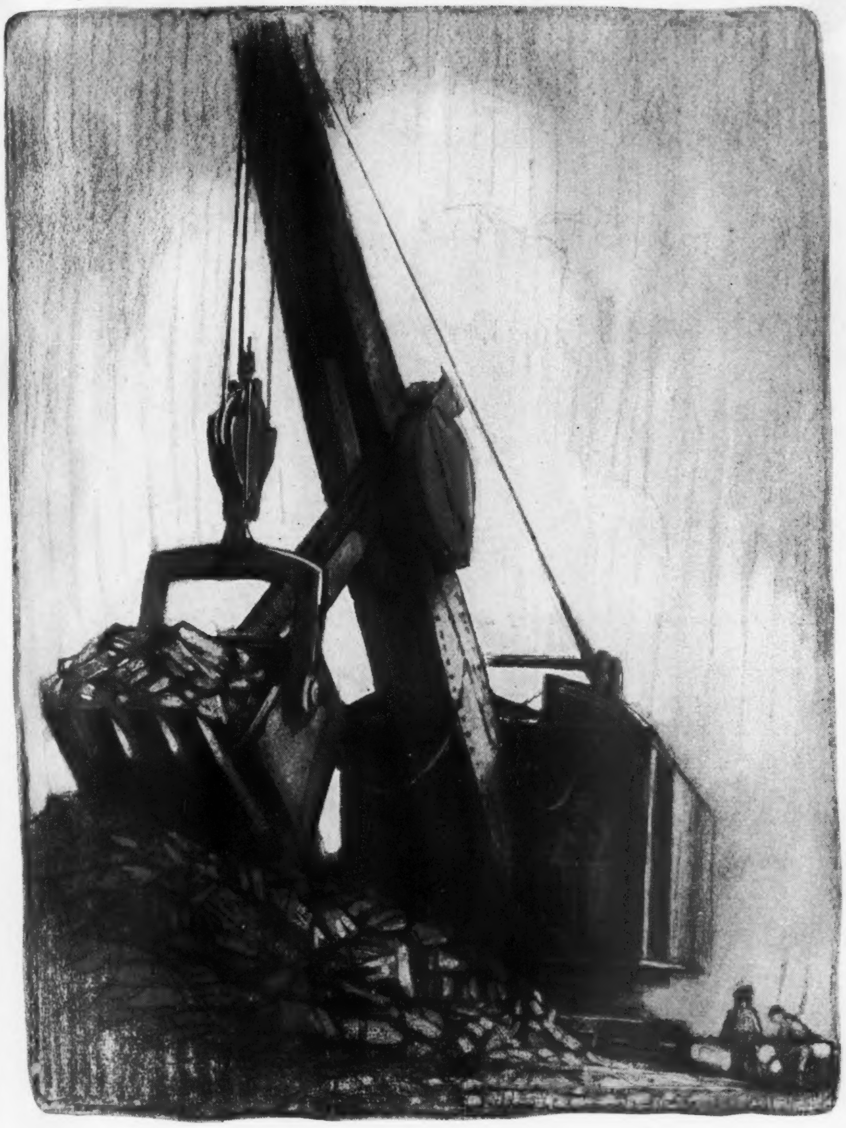
The Sauerman Power Drag Scraper likewise provides a reliable, efficient, economical method of storing and reclaiming sand, gravel and crushed rock.

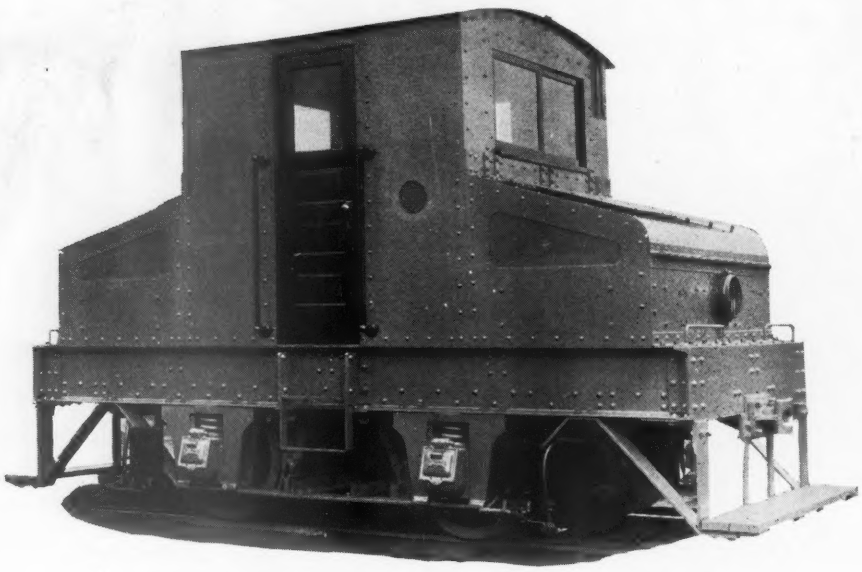
From a few to thousands of cubic yards per day, there is a Sauerman Power Scraper for every capacity requirement. No regular storage area of a certain size or shape is required. A Sauerman outfit may be adapted to practically any situation. In addition, the investment is relatively low. And operating and maintenance costs are low, because one man makes up the entire gang. If you are interested in learning more about cutting storage costs, send for a copy of "Storage of Bulk Materials with Power Scrapers," a well illustrated, 48-page book.

SAUERMAN BROS., Inc., 430 So. Clinton St., Chicago

SAUERMAN

SLACKLINE CABLEWAYS & POWER DRAG SCRAPERS

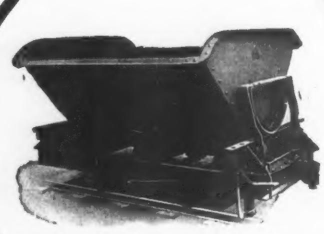




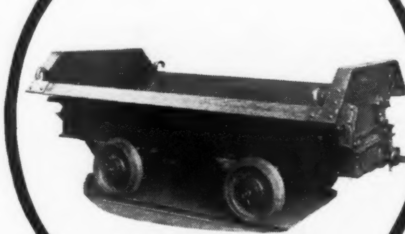
17-Ton Storage Battery Locomotive in Quarry Service

Cut Your Haulage Costs
With
ATLAS Cars and Locomotives

Atlas Storage Battery Locomotives are specially adapted to quarry haulage because of their economical operation features and their freedom from maintenance costs. They have great overload capacity for short periods of time, which enables them to start surprisingly heavy loads, and on account of their uniform torque they can start and haul heavier loads than a steam or gasoline locomotive of the same weight.



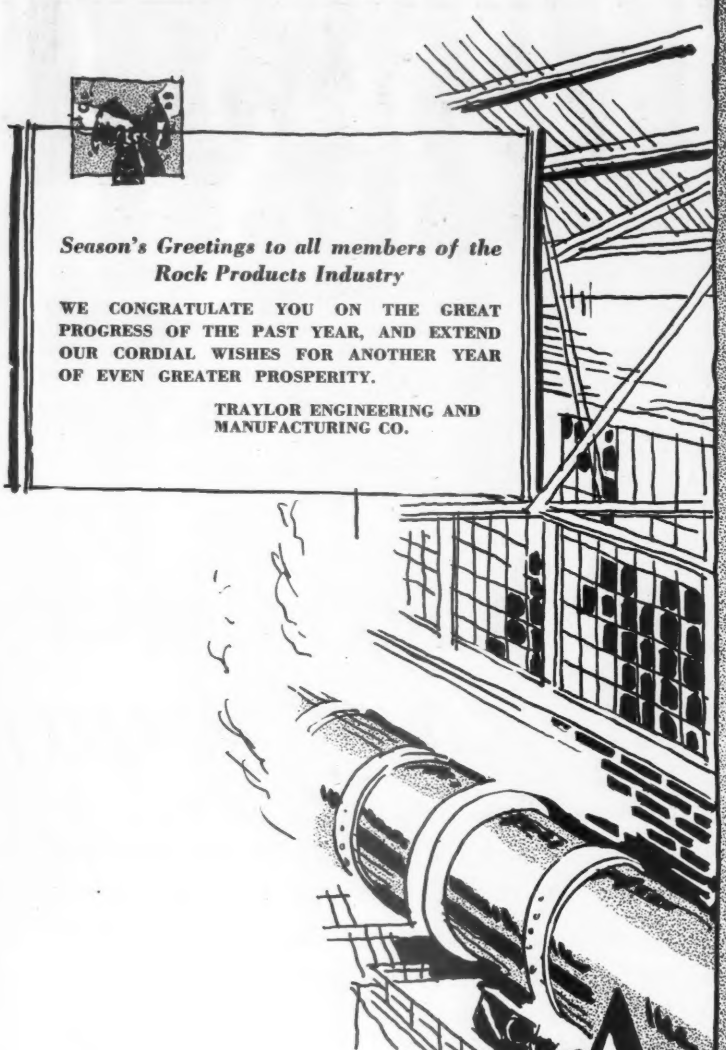
Rocker Dump Car with Brakes

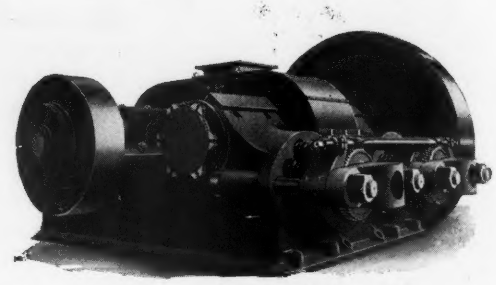


Heavy Duty Rock or Quarry Car

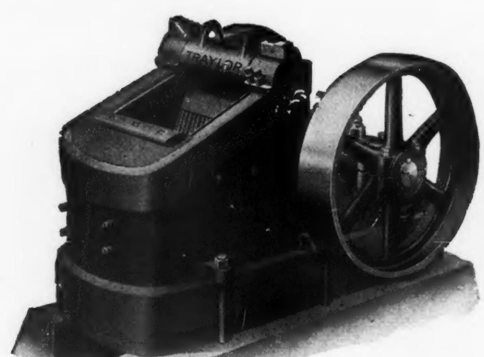
Atlas Cars are proven money-savers. Long and specialized experience in quarry car construction has enabled us so to perfect design and construction that Atlas Cars are unsurpassed in ruggedness and endurance. They hold up through years of severe service meted out to cars in the rock products industry.

The Atlas Car and Manufacturing Co.
CLEVELAND, OHIO, U. S. A.





Traylor Crushing Rolls have the sturdiness that typifies all Traylor equipment. Invaluable where extra fine product in large quantity is desired.



The Traylor Bulldog Jaw Crusher is exclusive and distinctive as to special reinforced frame, frictionless toggle system, and automatic self-alignment of working parts.

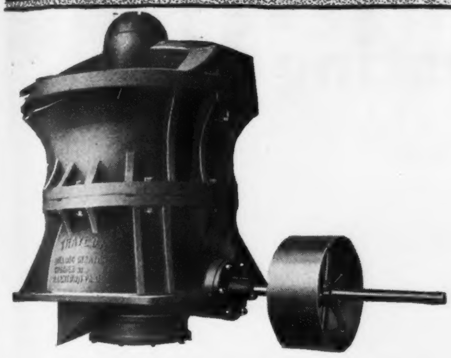
Another

in 1926 TRAYLOR *established new equipment standards*·

This past year, as in years before, Traylor has again been "first with the largest." Early in 1926, we undertook the construction of two great rotary kilns, 13 ft. 0 in. to 11 ft. 0 in. dia. x 343 ft. 9 in. long, built on five single roller supports.

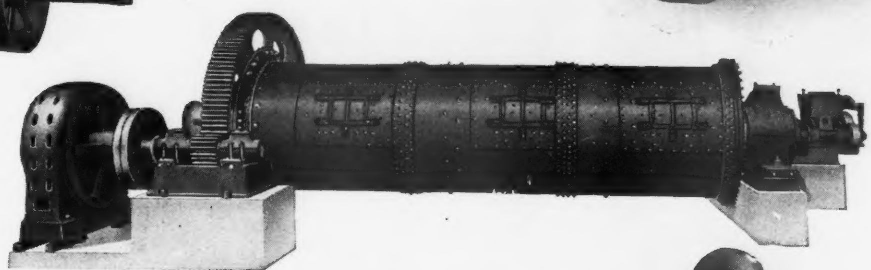
These are the World's Largest Rotary Kilns, and rank among the most progressive engineering achievements of the year.

As a prominent manufacturer of Cement Making, Stone Crushing, Mining and Ore Dressing, Smelting and Briquetting Equipment of all kinds, Traylor is prepared to accept any, or all, responsibility in the outfitting of new plants. Our facilities assure prompt attention, and action, on contracts of any size.

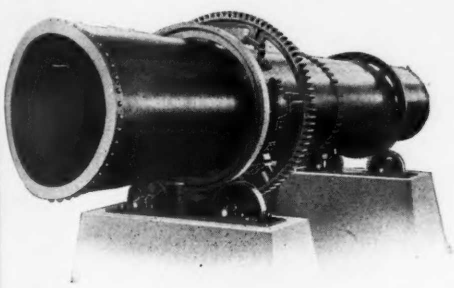


In the past year, Traylor has made great progress in the perfection of rotary kilns. The new Traylor Single Roll Support makes permanent alignment of a Traylor Kiln a matter of course.

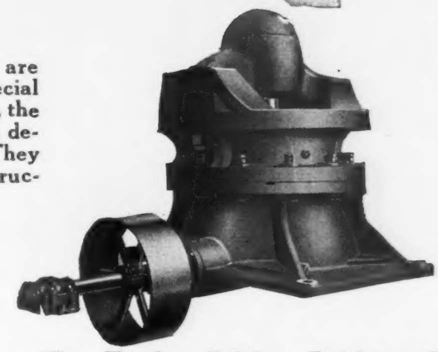
The Bulldog Gyratory Crusher is the most improved machine of its kind today available—possessing many new and exclusive features which contribute to efficiency of operation and economy of maintenance.



Traylor Compartment Mills are distinguished by many special features, of which the feeders, the diaphragm and the discharge device are the most notable. They are of the most sturdy construction throughout.



Traylor Rotary Dryers are offered in sizes to meet all requirements in either the direct fired,—single-shell type, or the indirect, brick housed design.



The Traylor Bulldog Finishing Gyratory Crusher is an oversize machine particularly adapted for the production of small sizes. It may be used after the initial or secondary breaker or as an auxiliary.

year of progress

Later in the year, Traylor again contracted for a "world's largest" undertaking. Two 8 ft. 0 in. x 40 ft. 0 in. and one 8 ft. 0 in. x 30 ft. 0 in. Compartment Mills are now under way—the largest ever attempted. These are indications of the fact that Traylor is today maintaining its forward stride.

A few selections from the large line of Traylor products are shown on this page. Descriptive catalogs of all classes of equipment may be obtained on request. Ask for our general catalog No. 3000, and for detailed information concerning the particular machinery in which you are most interested.

TRAYLOR ENGINEERING AND MANUFACTURING COMPANY, Allentown, Penna.

NEW YORK 30 Church St. — CHICAGO 1414 Fisher Bldg. — LOS ANGELES I. W. Hellman Bldg. — SEATTLE 815 Alaska Bldg. — SALT LAKE CITY 100 W. 2nd South St.

TIMMINS, ONTARIO, CANADA, Moore Block

Export Department, 104 Pearl St., New York City—Cable Address: "Forsaltra"

International Machy. Co., Santiago, Chile.
International Machy. Co., Rio de Janeiro, Brazil.
S. Oppenheimer & Co., Ltd., Rangoon, India.
General Electric (S. A.), Buenos Aires
International Machy. Co., Sao Paulo, Brazil.
W. R. Grace & Co., Lima, Peru.
British & Foreign Machy. Co., London.

European Works: Ghent, Belgium, Usines Carels Freres.

In "Perfect" Woven Screens the Holes Make the Profits

They screen more feed—they screen it cleaner—and they need less time, less power, to do it.

THEY screen more uniformly. Because "Perfect" screens are properly, accurately and honestly woven, the holes are permanently uniform in size and shape, and positively accurate.

The Wires in "Perfect" Screens Save Your Money

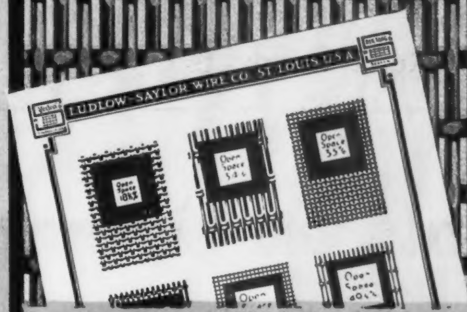
Light or heavy, tempered or annealed, rigid or flexible, pure metal or complex alloy, the wire in every Ludlow-Saylor Screen is the finest yet developed for its purpose—full gauge, full strength, full-value wires in warp and shoot. No false economies of cheapened weaving.

And "Perfect" weaving brings out the finest qualities of the metal. The fullest strength and vitality of the wire is preserved and reinforced in every crimp. No crystallized metal here—no strains nor broken surfaces — but maximum resistance to abrasion, vibration, corrosion, pressure, shock, with minimum hindrance to flow of feed or passage of fines.

Considering the marked economies of "Perfect" Screens in operation, and the more-than-usual value of the product they produce, the price of Ludlow-Saylor Screens is always advantageous.

The Ludlow-Saylor Screen Book brings "Perfect" Wire Cloth Service to your desk. Engineers and Operating Departments everywhere depend on it for handy, reliable and intelligent Wire Cloth data. The comprehensive tables list A Thousand Standard Screens by *mesh*—and then re-list them all by *openings*. Hundreds of full-size illustrations simplify selection; and 5000 actual Wire Cloth samples, always at your command, facilitate comparative tests. They make easy a discriminate choice of new screen surfaces, or a positive check on the screens you have been using.

Send for Your Copy of Screen Book No. 47-H4—The Text-Book on Screens. Free on request, of course—no obligation.

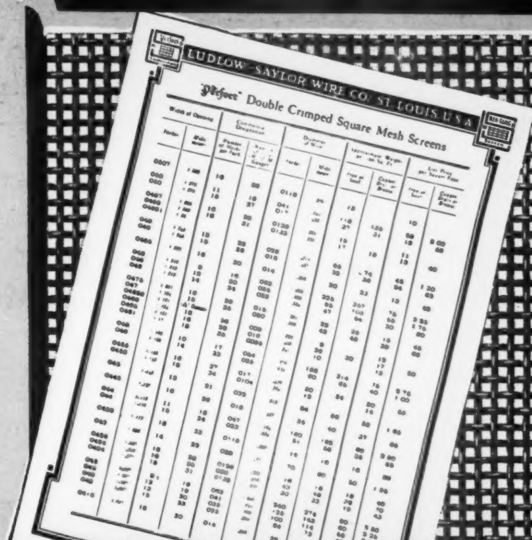


Ludlow-Saylor Wire Cloth

properly selected and applied to process equipments, saves power, time, attendance and replacement costs, improves the product and increases output.

The direct cost of Wire Cloth is a very minor item in the total of Operating Expense.

But choose the RIGHT SCREEN, and the same equipment will turn out cleaner, more uniform work, require less attendance and power, and *handle more tons* per machine, per square foot, per screen-cloth, per man, per hour and per dollar.



"Perfect" Service

1. COMPLETE WIRE CLOTH SERVICE
2. ACCESSIBLE WIRE CLOTH SERVICE
3. RELIABLE WIRE CLOTH SERVICE
4. ADAPTABLE WIRE CLOTH SERVICE
5. ECONOMICAL WIRE CLOTH SERVICE

MEMO

THE LUDLOW-SAYLOR WIRE CO.
616 South Newstead Ave., St. Louis

Send us your New General Catalogue No. 47-H4 We use

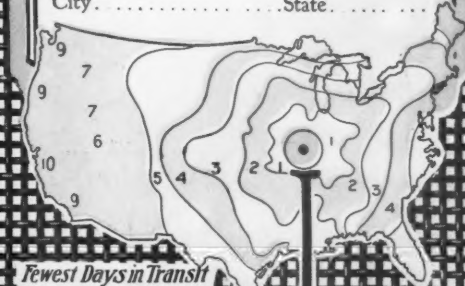
☐ Grinding Equipment ☐ Filter Equipment
☐ Screen Equipment ☐ Tumbling Equipment

Send samples as follows:...........

FIRM...........

By...........

City........... State...........



The LUDLOW-SAYLOR WIRE COMPANY St. Louis

616 South Newstead Ave.

CONNEAUT HT

HT There's a new mark appearing on the ferrules of Conneaut Special Shovels. It is a combination of two letters, H. and T. Originally they stood for the words "Heat Treated." But the shovels marked HT are so far superior to any ordinary heat treated shovels, the process that makes them is a development advanced so far beyond the usual heat treating methods, that HT has ceased to mean "heat treated." HT stands for a shovel, spade, or scoop made of carbon steel by a new process that produces hardness, resistance to wear, and flexibility.

Until the discovery of the HT process, it was believed that a hard shovel could not be flexible. Therefore the best shovels were made with a hard edge and a soft back. Although flexibility is not necessary for the ordinary work of shoveling, it is most necessary to withstand the abuse to which nearly every shovel is subjected. When a flexible shovel is subjected to an abusive strain, it bends—and may be bent back again. When a hard shovel is subjected to such a strain, it breaks.

This disadvantage is overcome in the HT shovels. The entire shovel is as hard as the edge, and yet it is just as flexible, just as sure to bend instead of breaking, as the soft-back shovel.

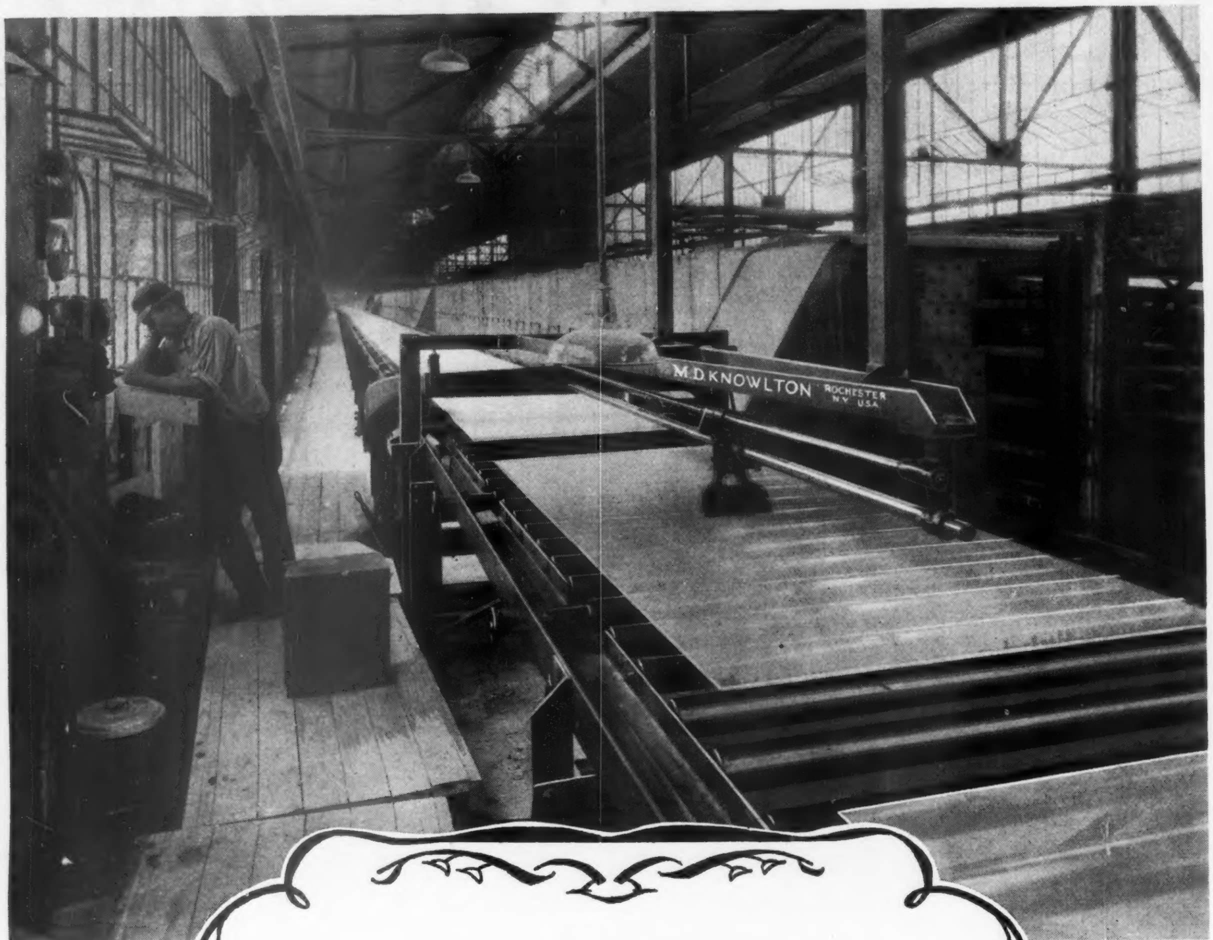
Conneaut Special Shovels differ from the old Conneaut Special Shovels only in the matter of this extraordinary heat treating. All the old features that made Conneaut Special Shovels extraordinarily good tools are retained.

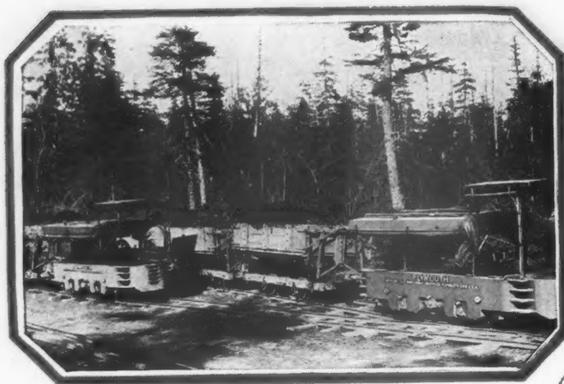
The Conneaut Special HT Shovel is built to stand any and all kinds of abuse. You can pry with it, beat it, bend it, twist it again and again. It will fly back and resume its original shape and show no sign of the abuse. We believe the Conneaut HT Special Shovel to be the finest shovel ever developed by any shovel manufacturer.

Conneaut Shovel Co.

CONNEAUT - - - - OHIO

SHOVELS


M.D.KNOWLTON ROCHESTER N.Y. U.S.A.



WILLIAMS AND DOUGLAS
TACOMA, WASHINGTON

From Coast

Plymouths Predominate in the

A Partial List of Users—

Abel Magnesia Co. (2)	Cedarville, O.
Alpena Gravel Co. (2)	East Tawas, Mich.
Alpha Portland Cement Co. (4)	Easton, Pa.
American Crushed Rock Co. (3)	Cleveland
American Crushed Rock Co. (2)	Los Angeles
American Lime & Stone Co. (3)	Tyrone, Pa.
American River Sand & Gravel Co.	San Francisco
American Trona Corp. (2)	Trona, Calif.
Arrow Sand and Gravel Co.	Columbus, O.
Atlas Portland Cement Co. (3)	New York
Atlas Rock Co. (3)	Stockton, Calif.
Ayers Mineral Co. (3)	Zanesville, O.
Baker Co., J. E. (2)	York, Pa.
Bald Mountain Quarries (2)	Newsom, N. C.
Balf Co., Edward (3)	Hartford, Conn.
Bennett Gravel Co. (4)	Spring Lake, N. J.
Bethlehem Mines Corp. (11)	Bethlehem, Pa.
Blue Diamond Co. (2)	Los Angeles
Blue Mountain Stone Co. (3)	Hagerstown, Md.
Bluffton-Lewisburg Stone Co. (4)	Findlay, O.
Bound Brook Crushed Stone Co. (5)	Bound Brook, N. J.
Boston Sand & Gravel Co.	Boston
Bradford Sand Mining Co. (2)	Centerton, Ind.
British Columbia Cement Co.	Vancouver, B. C.
Buffalo Crushed Stone Co. (7)	Buffalo
Builders Crushed Rock Products Co. (4)	Los Angeles
Burt Core Sand Co. (2)	Detroit
Cail, George F. (2)	Miami, Fla.
Calaveras Cement Co. (2)	San Francisco
Calcite Quarry Co. (2)	Myerstown, Pa.
Canada Cement Co. (4)	Winnipeg, Man.
Carroll Sand Co., J. E. (4)	Buffalo, N. Y.
Cayuga Operating Co. (3)	Portland Point, N. Y.
Celite Co. (7)	Los Angeles
Certainteed Products Corp.	St. Louis
Clark Rock & Gravel Co. (4)	Los Angeles
Columbia Quarry Co. (7)	St. Louis
Commonwealth Quarry Co. (4)	Summit, N. J.
Connecticut Lime Co.	Lee, Mass.
Connecticut Quarries Co. (4)	New Haven, Conn.
Consumers Rock & Gravel Co. (6)	Los Angeles
Detroit-Oxford Gravel & Sand Co.	Oxford, Mich.
Dick Sand Co. (2)	Franklin, Pa.
Eaton Canyon Rock & Gravel Co.	Pasadena, Calif.
Everett Co., Edward H. (2)	Newark, O.
Fenton-Parker Material Co. (4)	San Diego, Calif.
Ford Plate Glass Co., Edward	Rossford, O.
Ford Motor Co. (2)	Glassmere, Pa.
Florida Portland Cement Co.	Tampa, Fla.
General Stone Co.	Amherst, O.
Gibsonburg Lime Products Co.	Gibsonburg, O.
Gopher Stone Co. (3)	Minneapolis
Gordon & Harrison (2)	Los Angeles
Great Lakes Dredge & Dock Co.	Chicago
Great Lakes Portland Cement Co.	Buffalo
Grove Stone & Sand Co. (3)	Lemden, N. C.
Hagersville Quarries, Ltd. (4)	Hagersville, Ont.
Harris & Hull, Inc. (5)	Los Angeles
Hartford Sand & Stone Co. (4)	Hartford, Conn.
Havana Gravel Co.	Michigan, Tex.
Hazel-Atlas Glass Co. (2)	Wheeling, W. Va.
Herog & Son, John (2)	Forest, O.
Hiddenite Crushed Stone Co. (2)	Hiddenite, N. C.
International Cement Corp. (3)	New York
Jackson Sand Mining Co. (2)	Jackson, O.
Jones Sand Co. (2)	Columbus, O.
Katterjohn Construction Co., F. W. (2)	Princeton, Ky.
Keener Sand & Clay Co. (2)	Columbus, O.
Kelley Island Lime & Transport Co. (2)	Cleveland
Keller Lime Co., O. J.	Frederick, Md.
Kilbuck Sand & Gravel Co. (2)	Kilbuck, O.
Killins Gravel Co. (2)	Ann Arbor, Mich.
Kittanning Limestone Co.	Kittanning, Pa.
Knickerbocker Lime Co. (3)	Philadelphia
Knickerbocker Portland Cement Co. (2)	New York
Lane & Son, Inc., John S. (4)	Springfield, Mass.
Lassiter Co., Robt. G. (5)	Raleigh, N. C.
Lawrence Portland Cement Co. (6)	Northampton, Pa.

CALAVERAS CEMENT CO.
SAN FRANCISCO (2 PLYMOUTHS)

ORANGE COUNTY ROCK CO.
ORANGE, CALIF. (9 PLYMOUTHS)

Plymouth Locomotives are made in 3 to 25-ton sizes and in any gauge.

PLYM

Gasoline

to Coast

Stone, Sand and Gravel Field

Note the Repeat Orders

Lee Lime Co.	Lee, Mass.
Lehigh Portland Cement Co. (8)	Allentown, Pa.
Lincoln Sand & Gravel Co. (3)	Lincoln, Ill.
Los Angeles Rock & Gravel Co. (2)	Los Angeles
Louisville Cement Co. (3)	Louisville, Ky.
McCalmont Estate, S. P. (2)	Franklin, Pa.
Menantico Sand & Gravel Co. (2)	Millville, N. J.
Merion Lime & Stone Co. (3)	Norristown, Pa.
Midland Sand & Gravel Co.	Alsdorf, Texas
Miller, Clifford L. (2)	New York
Mississippi Lime & Material Co. (3)	Alton, Ill.
Monolith Portland Cement Co. (2)	Los Angeles
Morris County Crushed Stone Co. (21)	Morristown, N. J.
National Mortar & Supply Co. (7)	Gibsonburg, O.
National Quarries Co. (3)	Carey, O.
National Sand & Gravel Co. (2)	Trenton, N. J.
Nazareth Cement Co. (3)	Nazareth, Pa.
New England Lime Co. (5)	Canaan, Conn.
New Lexington Sand Co. (2)	New Lexington, O.
Niles Sand, Gravel & Rock Co. (2)	Niles, Calif.
Northern Illinois Supply Co.	Rockford, Ill.
Ocala Lime Rock Co. (5)	Ocala, Fla.
Ohio Hydrate & Supply Co. (5)	Woodville, O.
Ohio Quarries Co.	Cleveland
Old Mission Portland Cement Co.	San Francisco
Orange County Rock Co. (9)	Orange, Calif.
Pacific Portland Cement Co. (2)	San Francisco
Palmer Lime & Cement Co. (2)	York, Pa.
Palmer Rock Co., Geo. H. (2)	Miami, Fla.
Peerless Portland Cement Co.	Union City, Mich.
Pennsylvania Cement Co. (2)	Nazareth, Pa.
Phoenix Portland Cement Co. (3)	Philadelphia
Phoenix Stone Co. (2)	New York
Pittsburgh Limestone Co. (8)	New Castle, Pa.
Provincial Lime Co.	St. John, N. B.
Red Bank Gravel Co. (2)	Cincinnati, O.
Richland Sand Products Co. (2)	Pittsburgh, Pa.
River Products Co. (2)	Iowa City, Ia.
Riverside Lime & Stone Co.	Chicago
Roberts Harbor Granite Co.	Vinal Haven, Me.
Robertson, Ltd., A. W.	Ivanhoe, Ont.
Rochester Sand & Brick Co. (3)	Rochester, Mich.
Rock Hill Quarry Construction Co. (2)	Rock Hill, Mo.
Rockhold, L. C. (3)	West Mansfield, O.
St. Mary's Cement Co. (4)	St. Mary's, Ont.
Saluda Crushed Stone Co.	Greenville, S. C.
Santa Catalina Island (2)	Catalina Island, Calif.
Service Rock Co.	Fresno, Calif.
Shiely Co., J. L. (2)	St. Paul
Spring Lake Gravel Co.	Barrington, Ill.
Standard Gypsum Co. (3)	Ludwig, Nev.
Standard Lime Co.	Joliette, Que.
Standard Lime & Stone Co. (5)	Baltimore
Standard Sand & Gravel Co. (2)	Lillington, N. C.
Stratton Pulp Stone Co., H. E. (2)	Toronto, O.
Superior Sand Co. (4)	Cleveland
Templeton Limestone Co.	Templeton, Pa.
Tennessee Cement & Lime Co.	Nashville, Tenn.
Terre Haute Gravel Co.	Terre Haute, Ind.
Texas Cement Plaster Co.	Oklahoma City, Okla.
Thomasville Stone & Lime Co.	Thomasville, Pa.
Three Forks Portland Cement Co. (3)	Denver, Colo.
Triangle Sand Co. (2)	Mamaroneck, N. Y.
Trumbull Stone & Sand Co.	Warren, O.
U. S. Gypsum Co. (2)	Chicago
Universal Portland Cement Co. (4)	Chicago
Urschel Lime & Stone Co., Wm. L. (2)	Toledo, O.
Ventura Rock & Gravel Co. (2)	Ventura, Calif.
Vermont Marble Co.	Proctor, Vt.
Warner Co., Chas. (4)	Wilmington, Del.
Washington Building Lime Co. (2)	Baltimore
Wentworth Gypsum Co.	Dimmock, N. S.
Weston Sand & Gravel Co. (2)	Ansley, Miss.
White Hall Cement Mfg. Co. (5)	Philadelphia
White Rock Quarries (2)	Bellefonte, Pa.
Woodville Lime Products Co. (2)	Toledo, O.
York Hill Trap Rock Quarry Co. (2)	Meriden, Conn.

ROBERTS ISLAND GRANITE CO.
VINAL HAVEN, MAINE

LAWRENCE PORTLAND CEMENT CO.
SIEGFRIED, PA. (5 PLYMOUTHS)

OCALA LIME ROCK CO.
OCALA, FLA. (7 PLYMOUTHS)

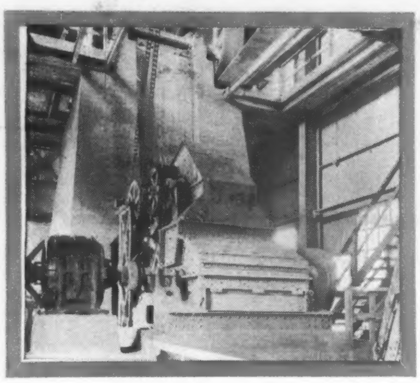
THE FATE-ROOT-HEATH CO.

Plymouth Locomotive Works

Plymouth, Ohio

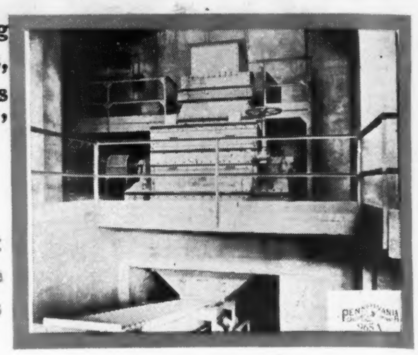
OUTH
Locomotives

3 "PENNSYLVANIAS" *Sell* 4th

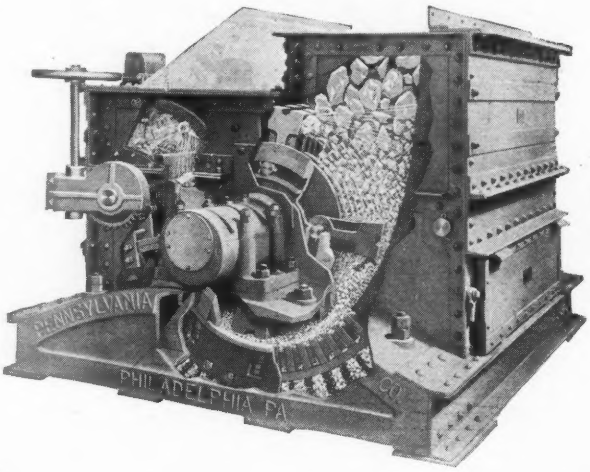


On the performance secured by equipping three Plants with *STEELBUILT* Hammermills, one of the largest Cement Companies has recently ordered another "Pennsylvania," for a fourth plant.

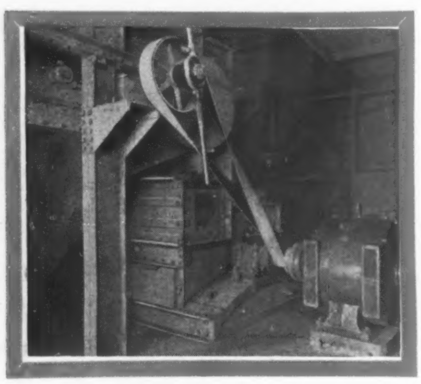
Many seasoned operators tell us that Crushers cannot be built too good for the bruising service which modern Cement Mills demand,—and they buy "Pennsylvanias."



Unbreakable Steel Frame Construction



Positive Tramp Iron Protection



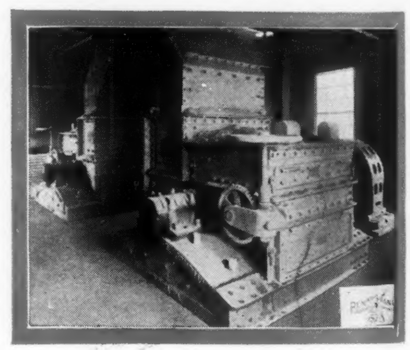
Adjustable STEEL Cage

ALL-STEEL Flywheel Rotor

Hinged Top-Cover

Reversible Cage Bars

Patented
Tramp Iron Separator



Whenever you are planning a new Mill or extending or modernizing your present Plant,—

Put Your Reduction Problems Up to Us

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PENNSYLVANIA CRUSHER COMPANY

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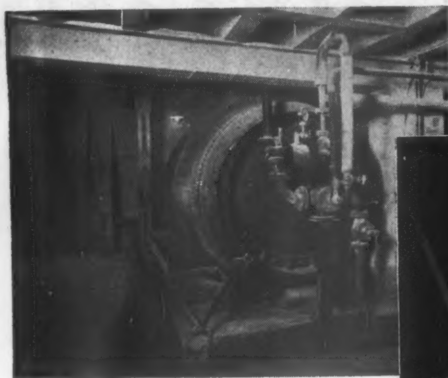
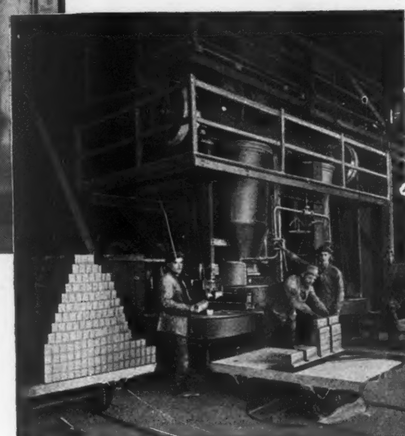
GENERAL OFFICES: Liberty Trust Bldg., Philadelphia

"PENNSYLVANIA" *STEELBUILT* CRUSHERS

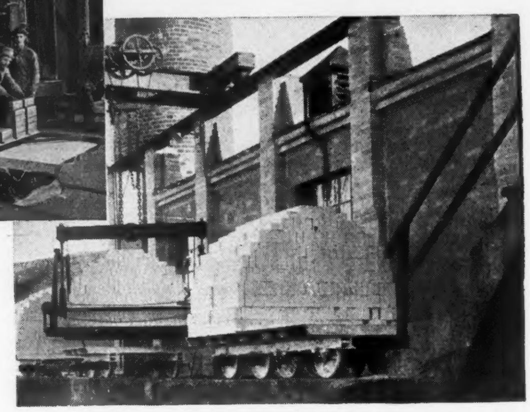
Simplest, Quickest and Most Reliable Method of Brick Manufacture





Successful Brick Manufacturers Recommend "Komnick Drum Process Machinery"

LARGEST PRODUCTION insured at low cost. **SUPERIOR QUALITY** creates ready market for **SAND-LIME BRICK** at pressed brick prices.



A sand-lime brick or slag brick plant adapted to your conditions and constructed according to KOMNICK plans will give you the best product at lowest cost.

For further particulars write

Komnick Machinery Company

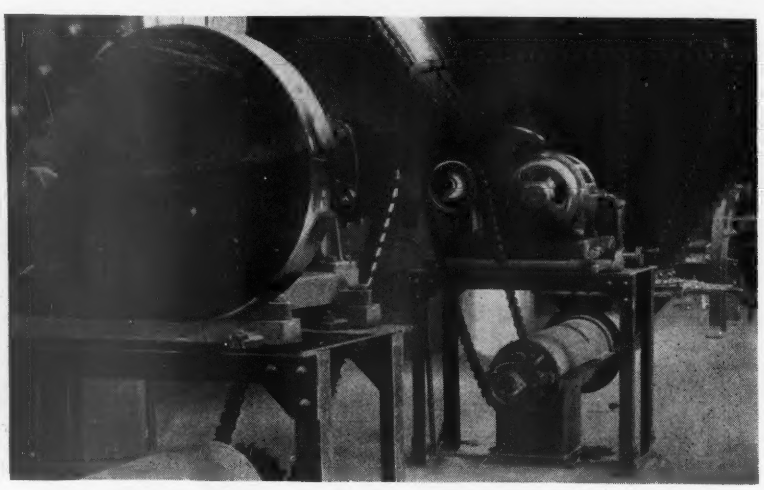
714 Lafayette Building Detroit, Michigan

FOR THAT BACK-GEARED MOTOR—Specify

WATSON-FLAGG—REDUCTION GEAR DRIVES

Standard Equipment on

Allis-Chalmers
Century
General Electric
Robbins & Myers
Westinghouse
MOTORS
as Back Geared Attachments



Installation at the American Lime & Stone Company's plant at Bellefonte, Pa.

Used by

Standard Lime & Stone Co.
Washington Building Lime Co.
Indiana Portland Cement Co.
Ogdensburg Limestone Products Co.
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New England Lime Co.

Requires but Little More Space Than Standard Motor

Rugged Construction—Totally Enclosed Gears and Bearings—Simple Design. Sizes 1/6 to 60 H. P.—Adaptable to Any Make of Motor—Ratios 3/1, 4/1, 5/1, 6/1, or 7/1

AVAILABLE FROM STOCK—IMMEDIATE SHIPMENT

WATSON-FLAGG ENGINEERING COMPANY

120 LIBERTY STREET **WRITE FOR BULLETIN** **NEW YORK, N. Y.**

BE SURE ITS A Moly

H-K-Wood's

Mo-lyb-den-um

The American Super Steel

Shovels

THE WOOD SHOVEL AND TOOL CO. PIQUA, OHIO, U.S.A.

Is there a "kick" in a shovel?

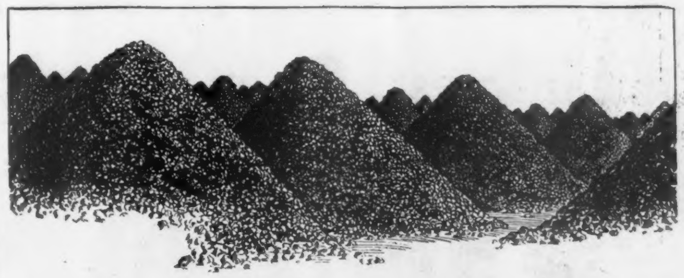
Everywhere workmen who use the Moly say there is—the kick of lighter weight and greater adaptability for the particular job.

It was a happy shoveler, thus released from the drudgery of his job, who called H. K. Wood's Mo-lyb-den-um Steel Shovel "Moly," and so we stood for the shortening of the trade mark name and he stood for the picture.

Fewer shovels to buy and fewer men to do more work is the whole story in sand and gravel pits as in other operations where these super-shovels are used.

Tougher, harder and lighter than any other shovel, they outlast half a dozen ordinary shovels and still remain serviceable, as has been proved in numberless tests and instances of every-day use.

THE WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio, U. S. A.



Of the fuel you burned this year, how much was lost through Radiation?

SEVENTEEN per cent of the fuel burned in an ordinary vertical shaft kiln "goes up in the air" in heat radiation from the fire box and kiln shell.

All of this waste cannot be stopped, of course. But it can be reduced to a third of that figure by incorporating heat insulation in the construction of the kiln.

Engineers who have checked the fuel demands of un-insulated kilns against those in similar service that have been insulated with Sil-O-Cel report an average fuel saving of twelve per cent — enough to repay the entire cost of insulating within the first year of average operation.

Oftentimes the price of the necessary insulation is less than the cost of the more bulky red brick construction it replaces. Let us send you full particulars — without obligating you in any way.

CELITE PRODUCTS COMPANY

SIL-O-CEL
HEAT INSULATION

CELITE PRODUCTS COMPANY

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(Please address office nearest you)

☐ Please send me your Engineering Service Bulletin W-20 on the insulation of lime and cement kilns.

☐ Please send me your 190 page textbook on heat insulation that is being distributed free of charge to engineers and plant executives.

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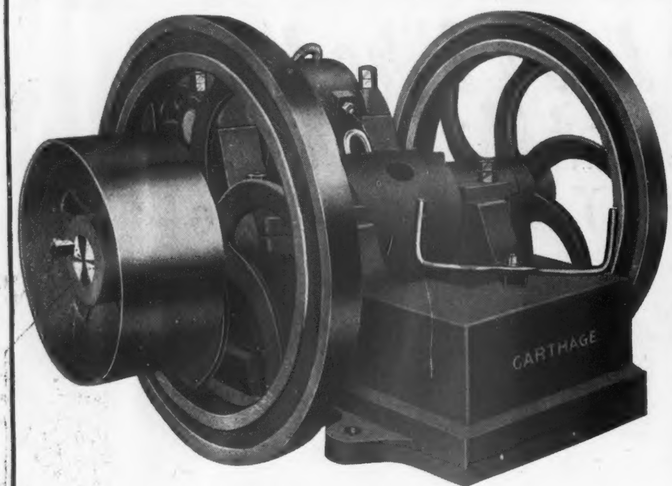

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"Blake Style"

RIGIDITY

CAPACITY

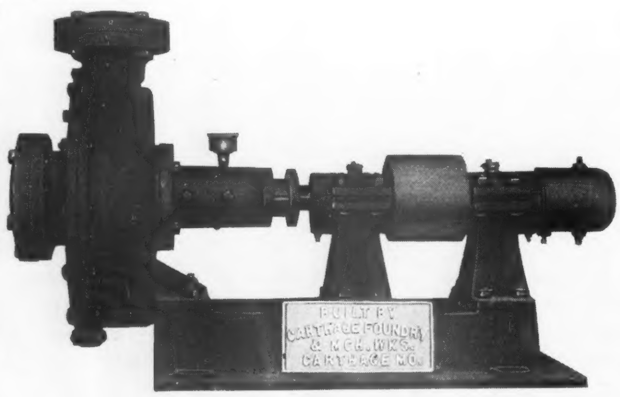
DURABILITY

This Style Crusher is specially adapted for QUARRY PLANTS, ZINC or LEAD MINES.

They will do it better, quicker, and at less cost.

TRY ONE

We manufacture Crusher Rolls and other Mining Equipment.



"CARTHAGE" OZARK SAND PUMP

For Pumping Sand, Gravel and Slimes

Maximum in Service—Minimum in Attention

Repeat Orders Tell the Story

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Carthage Foundry & Machine Works

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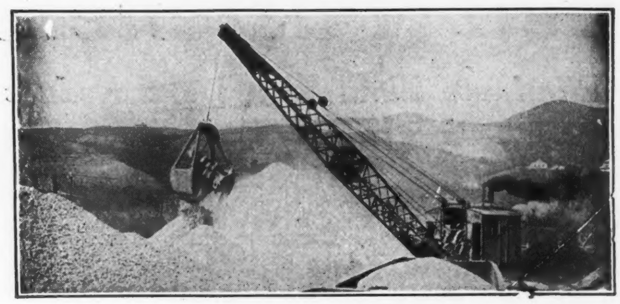
LOCOMOTIVE



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15 to 40 Ton Capacity

Steam or Motor Drive

When You Buy an Ohio Crane Here Is What You Get

A sturdy built Crane.
Steel constructed throughout.
A Crane which can be equipped to handle all kinds of material.
A Crane which has Power, Speed and Endurance.
A Crane which can be operated continuously.
A Crane that requires but few repair parts.
A Crane with all parts accessible.
A Crane that has a guarantee for 10 years.

What Guarantee Covers

Six Main Steel Parts

1—Machinery Base
1—Roller Path and Rock
1—Center Casting
2—Side Housings
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THE OHIO LOCOMOTIVE CRANE CO.

High Street, Bucyrus, Ohio

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30 Church St.

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LOCOMOTIVE OHIO CRANE

Today's Hauling Requires

Today's Locomotives

IN every respect, are your locomotives modern hauling units? Were they designed and built for today's stone hauling? Do they incorporate the latest industrial locomotive improvements?

Shays have kept right abreast of engineering developments. Men responsible for many of the latest locomotive improvements constantly strive to improve Shays—to give quarry operators the most efficient hauling power.

An example of this endeavor is the application of the superheater to every class of Shay. They give Shays increased capacity and effect a substantial saving in fuel and water.

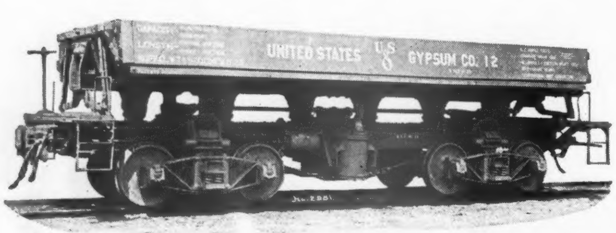
In every detail of their construction Shays are modern hauling units—completely fitted for hauling steam shovel loadings.

Would you like to know more about Shays?

LIMA LOCOMOTIVE WORKS
Incorporated
Lima, Ohio 17 East 42nd St., New York

LIMA Shay Geared LOCOMOTIVES

Before you buy any car—See this fine Koppel Product!



Positive in action — safe and reliable, this car has won the good will of both the owner and the workmen.

It discharges clean and free, speeds up the work, saving labor. Built securely, it stands the crushing strains of heavy duty.

In various capacities, in both lift door and drop side types.

Rental terms if desired.

Write for Bulletins

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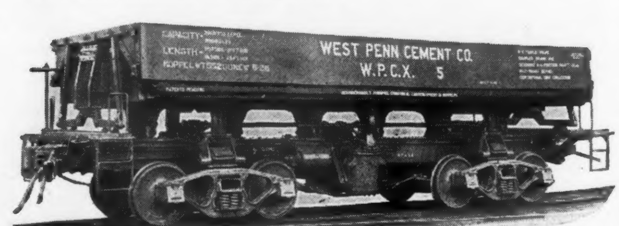

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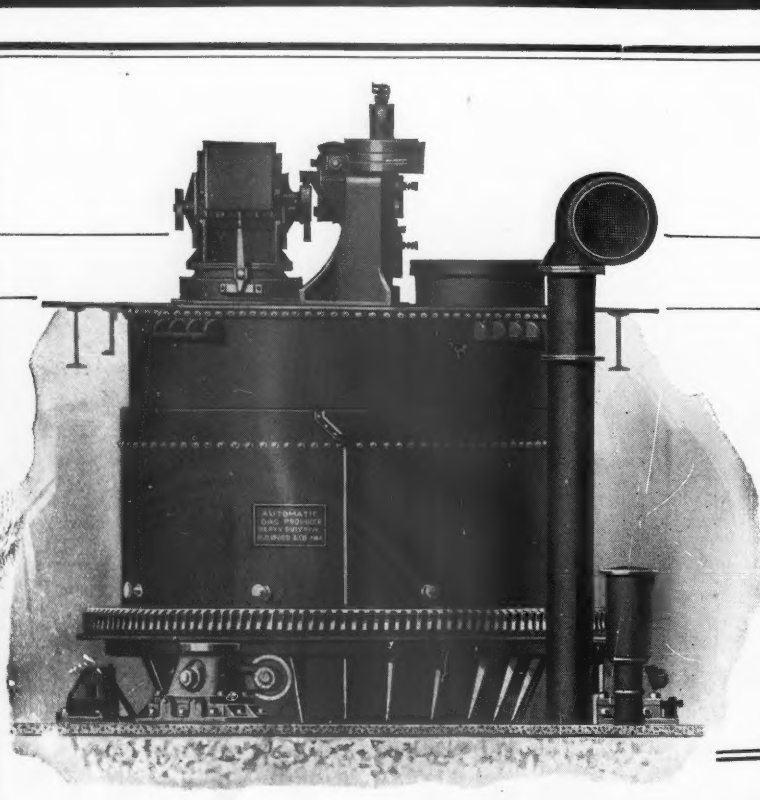
AUTOMATIC



Will 1927 bring disaster to your crusher—or protection

How's it going to be in 1927? Will you continue to leave your crushing equipment open to tramp iron havoc, trusting to luck that it will get by? Will you keep on gambling against the chances of a smash-up? Or will you install a "High Duty" Magnetic Separator and strike that big item off your list of worries?

Right now, while you are planning economies and improvements for the coming year, is the best time to consider adequate protection for your crushers against the tramp iron menace that is sending other men's crushers to smash every day. Resolve that yours will not be the next one.

Remember: We guarantee the "High Duty" Ventilated Magnetic Separator to have the highest efficiency obtainable, due to correct construction and design.

HIGH DUTY Magnetic Separators

MAGNETIC MANUFACTURING CO.

201 24th Avenue **Milwaukee, Wis.**

S. B. W.

Super Lubricant means Super Lubrication

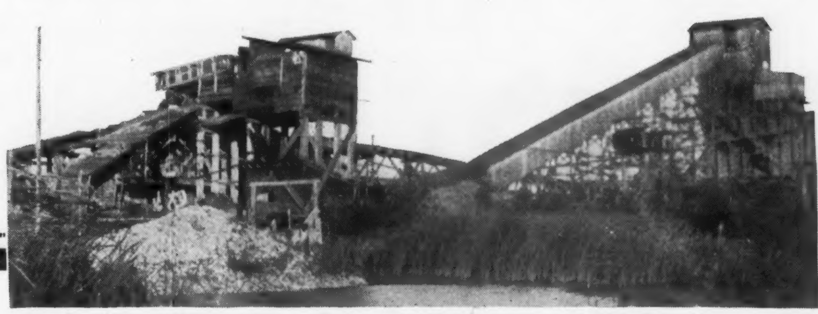
S. B. W. Super-Lubricant is made especially for the heavy duty work of the rock products industry. It is neither an oil nor a grease, but a lubricant which outwears and outlubricates any oil or grease in the world. Not only are the results better but the cost is actually less.

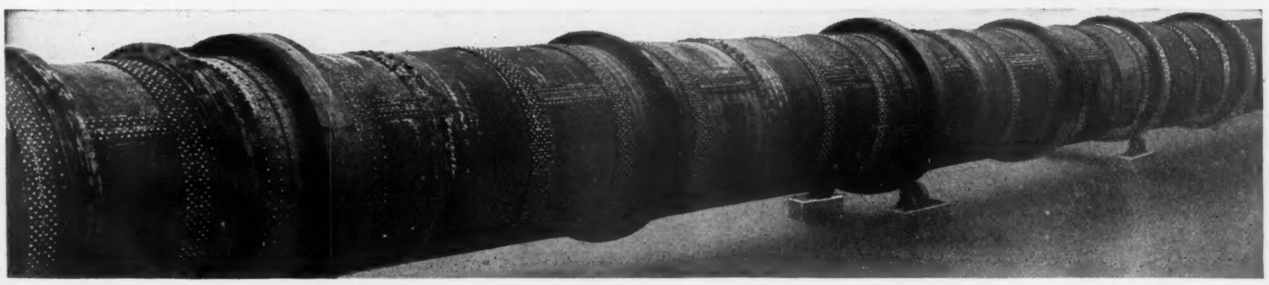
It will mean money in your pocket if you give S. B. W. Super-Lubricant an investigation. Write us today.

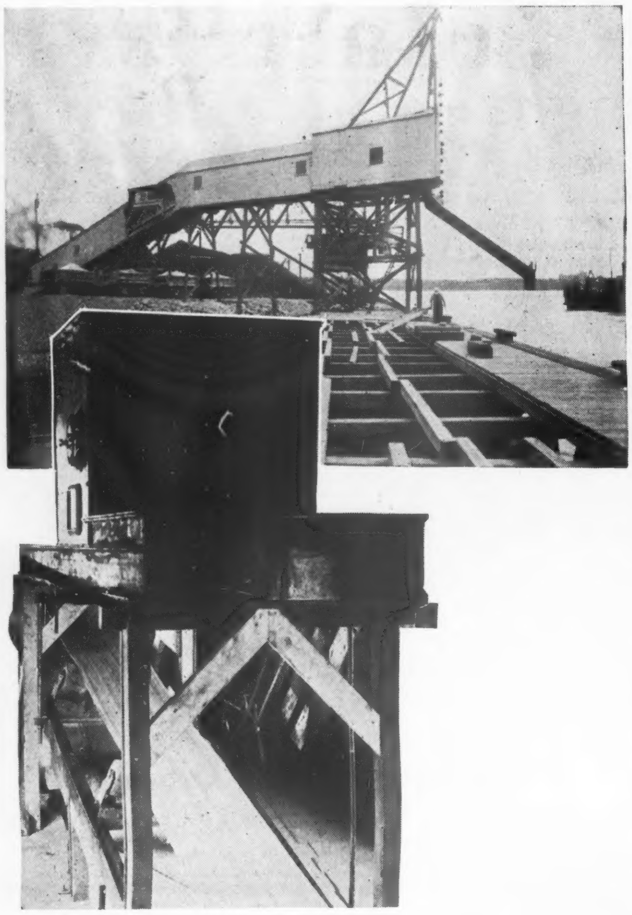
Lubrication Products Corporation

Plainville, Conn.

The Atlas Sand, Gravel & Stone Co., Farmington, Conn., uses S. B. W. Super-Lubricant throughout their plant shown below, with the exception of the motors and high-speed journals. They also use it, with the same exceptions, throughout their sand-lime brick plant. A year's use has sold them completely on the efficiency and economy of S. B. W.







THE MERRICK
Conveyor Weightometer

automatically keeps track of stone loaded out of a large stone plant in New England.

The new flux stone loading plant illustrated above has installed a Weightometer to weigh the 70,000 tons of limestone that will be shipped each year.

The Weightometer mechanically weighs and registers the weight of any material, which is conveyor handled.

No Weighman is needed.

Guaranteed and Proven 99% Accurate

MERRICK SCALE MFG. CO.
Passaic, N. J.

Milwaukee Cranes

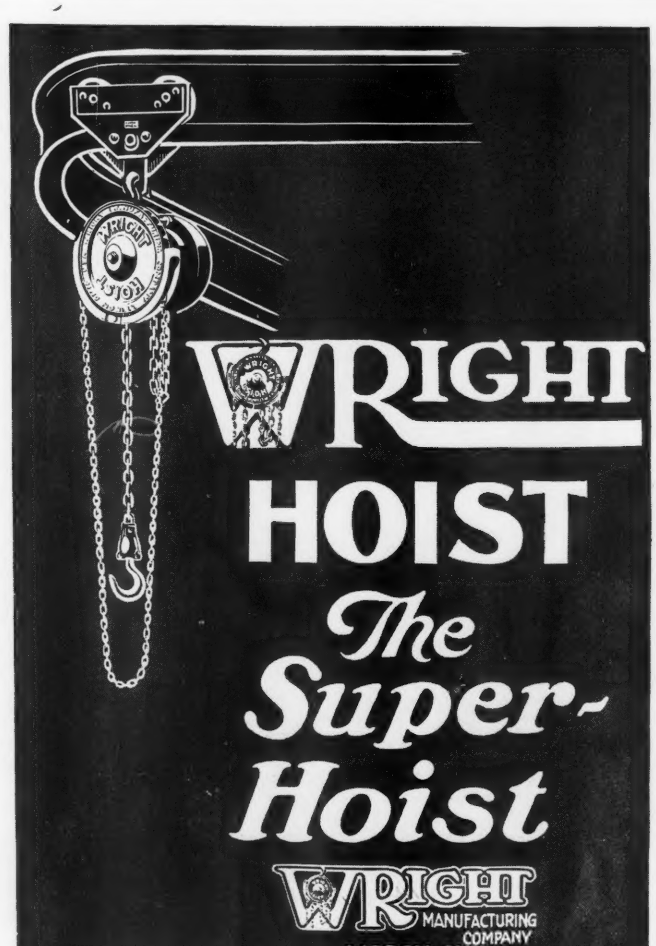
For Severe Mill Service

For the cement or rock products mill where the air is laden with destructive grit and dirt, the exclusive Milwaukee crane feature of positive oil lubrication assures longer life and lower maintenance costs than is possible with ordinary, grease lubricated traveling cranes. The installation above, Sandusky Portland Cement Co., is representative of such operating conditions.

Write for the Milwaukee Catalog and see why Milwaukee cranes last longer in mill service.

THE MILWAUKEE CRANE
A SYMBOL OF SERVICE

Milwaukee Electric Crane & Mfg. Corp.
Milwaukee Wisconsin



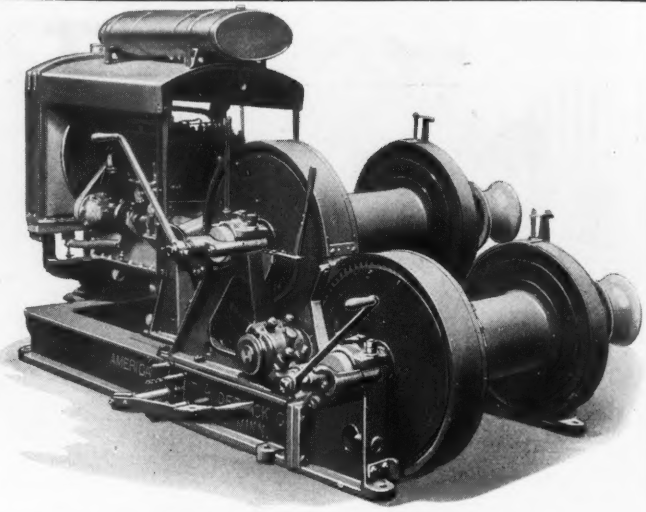
Deep Bin Storage

MACDONALD SYSTEM

We Have Built for Cement Plants
10,000,000 Barrels Capacity
and Have Under Construction
1,300,000 Barrels More

If your stockhouse, packhouse and baghouse operating costs are unsatisfactory, our experience might help you.

MACDONALD ENGINEERING CO.
53 West Jackson Boulevard
CHICAGO
Toronto San Francisco Baltimore

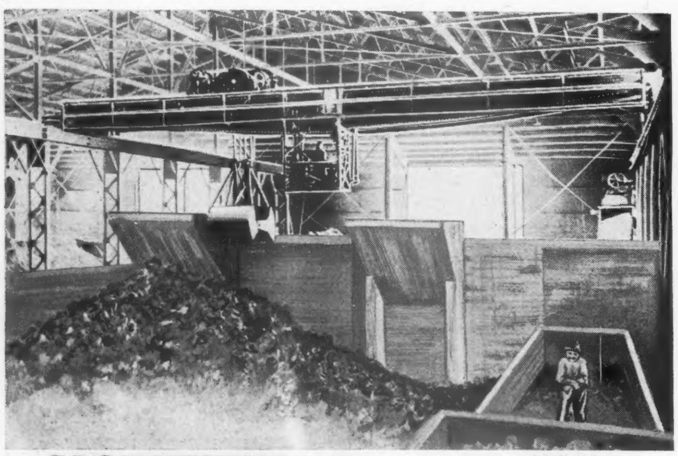


"AMERICAN" Gear Drive Gasoline Hoists

"AMERICAN" Gear Drive Gasoline Hoists are built to stand long hard runs with the same old reliability that has characterized "AMERICAN" Steam Hoists for nearly half a century.

All we ask is a chance to submit our proofs. As a starter, tell us to mail you one of our new booklets illustrating and describing "AMERICAN" Gasoline Hoists.

AMERICAN
HOIST & DERRICK CO.
Saint Paul, Minn.



NORTHERN Dependability
In Your crane work.

A sturdy crane that can be depended upon for the heavy service you require, is the Northern Grab Bucket Crane.

Feel free to consult our engineers on your particular crane and hoist problems. That's what they are for—and they are men of wide experience.

NORTHERN ENGINEERING WORKS
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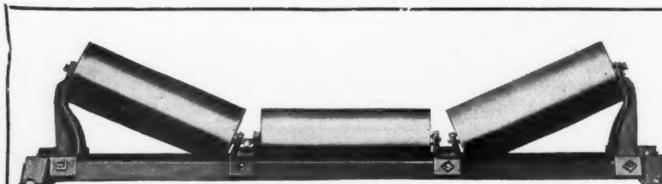
Branch Offices in All Principal Cities

NORTHERN GRAB BUCKET CRANE



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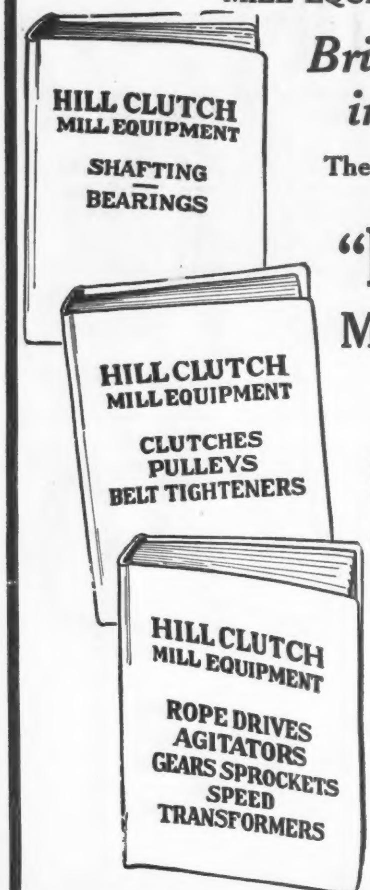
Rugged power saving idlers that cut the cost of carrying rock, sand and other materials to the minimum. Alemite grease fittings, Anti-Friction Timken bearings, sturdy design. Shafts 1-3/16-in. diameter. Made for belts 24 to 48 inches wide. Ask for special belt conveyor catalog.

TRIPPERS, ELEVATING and Conveying Equipment

We are prepared to submit prices and details on trippers for belt conveyors, wood or metal Elevators, bucket or drag, spiral conveyors, metal hoppers, spouts, bin bottoms, gates, valves, bearings, pulleys or any other sheet metal or transmission equipment. Write for a copy of our new catalog GG123 Monarch Material Handling Equipment. It will save you money.

SPROUT, WALDRON & CO.
1213 Sherman Street
Muncy, Pa.
In Business Since 1866

"HILL CLUTCH" MILL EQUIPMENT



Brim-full of new information!

The New General Catalog of

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It illustrates every phase of "HILL CLUTCH" MILL EQUIPMENT. In addition, it contains tables, diagrams, engineering data, etc., which eliminates guess work in the selection of proper power transmission units. Invaluable for reference.

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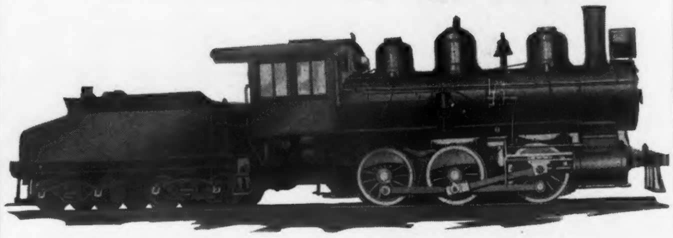
The Hill Clutch Machine and Foundry Co.

Power Transmission Engineers

General Office and Plant
Cleveland, Ohio

Quarry Equipment



55-ton, 18x24" American Locomotive Co. 6-driver Switcher; butt strap boiler, 180 pounds steam pressure; 44" wheel centers; 11' wheel base; straight and automatic air brakes; electric headlights front and rear. Built 1910. Now equipped as oil burner but will convert to coal if desired.

We Have Over Forty Locomotives in Stock Overhauled and Ready, All Types, 7 to 100 Tons

Rod and Geared, Narrow and Standard Gauge

ALSO

Steam Shovels, Cars, Rails, Cranes, Draglines, Etc., Overhauled

Immediate Shipment from Stock.

DUMP CARS

10—12-yard Western 2-way Air Dumps, steel underframe, steel beams; std. gauge.
14—6-yard Western 2-way Hand Dumps, steel beam, std. gauge, New Bodies.
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Southern Iron & Equipment Co.
Est. 1889
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CENTRAL
TRACK EQUIPMENT
FROGS—SWITCHES

Crossings, Tie-Plates, Rail Braces, Switch Stands, Steel Ties, Rails, Splice Bars

The Central Frog & Switch Co.
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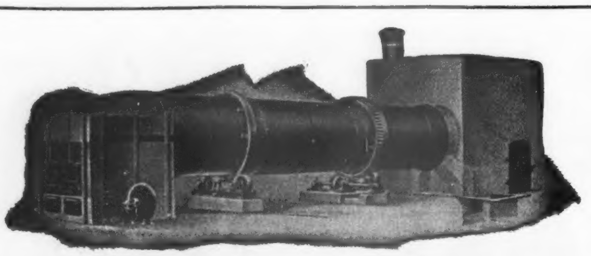

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Also Special Machinery, Castings, Forgings and Plate Work

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"SHAF-TITE"

Wood Conveyor Rolls
(Patented)

Rodney Hunt Machinery Company
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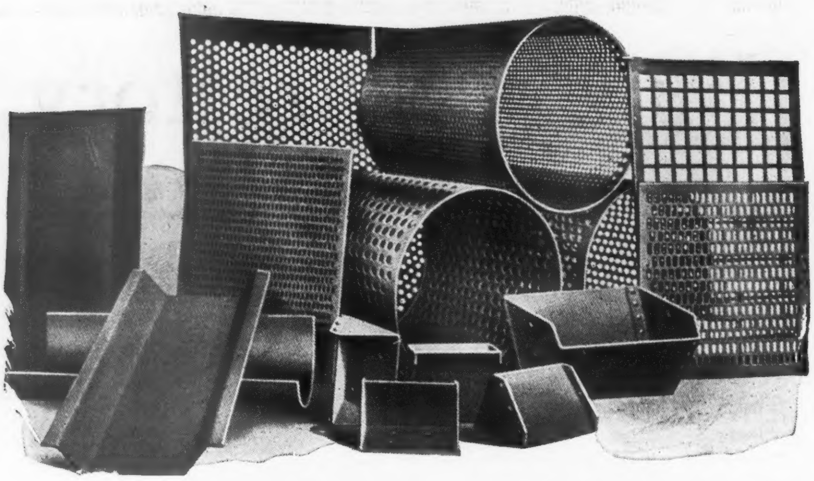

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Screens and Elevator Buckets

A policy of "quality four-square," strictly maintained for the past forty years, has won a legion of boosters for Hendrick Products throughout the stone, sand and gravel, slag, and lime industries.

We have for a long time made a specialty of screens, and elevator buckets for the rock products industry and consequently you can, with perfect confidence, depend upon us to fulfill your most exacting demands.

We carry one of the largest stocks of plate and sheet steel in the United States, and with our extensive manufacturing equipment your delivery problem is solved.

Elevator buckets in any desired size and shape. Screens in any size and type of perforation.

We also make Conveyor Trough and Flights, Stacks, Tanks, Chutes, Hoppers, Light and Heavy Steel Plate Construction.

Ask for Perforated Metal Hand Book.

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Carbondale, Pa.

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Hazard Mfg. Co., Wilkes-Barre, Pa.
Interstate Equipment Corp., New York, N. Y.—automatic—24
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Lidgerwood Mfg. Co., New York, N. Y.—64
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E. H. Stroud & Co., Chicago, Ill.—305

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Fuller-Lehigh Co., Fullerton, Pa.—78-79

AIR SEALS (Kiln)

Babcock-Wilcox, New York, N. Y.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Bonnot Co., Canton, O.—248
Edge Moor Iron Co., Edge Moor, Del.—57
Heine Boiler Co., St. Louis, Mo.
Manitowoc Eng. Works, Manitowoc, Wis.—293
J. S. Schofield's Sons Co., Macon, Ga.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—89

AIR SEPARATORS

Bradley Pulverizer Co., Allentown, Pa.—286
Clark Dust Collecting Co., Chicago, Ill.
The Dust Recov. & Conv. Co., Cleveland, O.
Federal Pneumatic Systems, Chicago, Ill.
R. M. Gay Co., Inc., New York, N. Y.—303
Guarantee Construction Co., New York, N. Y.
Hardinge Co., New York, N. Y.—66-67
Kent Mill Co., Brooklyn, N. Y.—276
The Kirk & Blum Mfg. Co., Cincinnati, O.
Komnick Machy. Co., Detroit, Mich.—278, 301

AIR SEPARATORS—Cont'd

The Northern Blower Co., Cleveland, O.
The Patterson Fdry. & Machine Co., E. Liverpool, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Roberts & Schaefer Co., Chicago, Ill.—25
W. W. Sly Mfg. Co., Cleveland, O.—243
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Universal Road Mchy. Co., Kingston, N. Y.—300
Williams Pat. Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

ALLOYS

Alcumite Corp., Dayton, O.—non-corroding metals
American Manganese Steel Co., Chicago Hts., Ill.
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Haynes Stellite Co., New York, N. Y.
Kensington Steel Co., Chicago, Ill.
Ludlum Steel Co., Watervliet, N. Y.—305

APPRAISERS

American Appraisal Co., Milwaukee, Wis.

ASBESTOS FRICTION BLOCKS AND BRAKE LININGS

Thomas L. Gatke, Chicago, Ill.—45

ASBESTOS PRODUCTS

Thomas L. Gatke, Chicago, Ill.—45
Johns-Manville, Inc., New York, N. Y.

ASH AND REFUSE HANDLING MACHINERY

American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
Austin Mach. Corp., Toledo, O.
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Birmingham Rail & Loco. Co., Birmingham, Ala.
The Brown Hoisting Machy. Co., Cleveland, O.—280
The Byers Machine Co., Ravenna, O.—18
Buffalo Weaving & Belting Co., Buffalo, N. Y.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Conveyors Corp. of America, Chicago, Ill.
Doolittle-Stephens, Ltd., Hagersville, Ont., Can.
The Dust Recov. & Conv. Co., Cleveland, O.
Easton Car & Const. Co., Easton, Pa.—10
Erie Steam Shovel Co., Erie, Pa.—47
The Fundom Hoist & Shovel Co., Lima, O.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., New York, N. Y.
The Hamilton Mfg. Co., Columbus, O.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Hayward Co., New York, N. Y.—11
Howe Chain Co., Muskegon, Mich.
Wilbur G. Hudson Corp., New York, N. Y.
C. W. Hunt Co., Staten Island, N. Y.
Industrial Works, Bay City, Mich.
Interstate Equip. Corp., New York, N. Y.—24
Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The McMyler-Interstate Co., Cleveland, O.—40
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover

ASH AND REFUSE, ETC.—Cont'd

New Holland Mch. Co., New Holland, Pa.—283
The Northern Blower Co., Cleveland, O.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Northwest Engineering Co., Chicago, Ill.—Insert bet. 2-3
Ohio Locomotive Crane Co., Bucyrus, O.—282
Orton Crane & Shovel Co., Chicago, Ill.—81
Palmer-Bee Co., Detroit, Mich.—6
Pawling & Harnischfeger Corp., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
J. W. Paxson Co., Philadelphia, Pa.—50-51
Portable Machinery Co., Passaic, N. J.
Sprout, Waldron & Co., Muncy, Pa.—298
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Union Chain & Mfg. Co., Sandusky, O.
The Universal Crane Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.
Wehr Company, Milwaukee, Wis.—truck tractor
Weller Mfg. Co., Chicago, Ill.—237

AUTOMATIC WEIGHERS

Merrick Scale Mfg. Co., Passaic, N. J.—296
Richardson Scale Co., Passaic, N. J.
Schaffer Poidometer Co., Pittsburgh, Pa.—5

AXLES (Locomotive and Car)

American Car and Foundry Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—260
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Pa.
Easton Car & Construction Co., Easton, Pa.—10
Gustafson Mfg. Co., Chattanooga, Tenn.
Helm Brick Machine Co., Cadillac, Mich.
Kenova Mine Car Co., Kenova, W. Va.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Lobdell Car Wheel Co., Wilmington, Del.
McMyler-Interstate Co., Cleveland, O.—40
Pennsylvania Casting and Machine Co., Pittsburgh, Pa.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.

BABBITT METAL

Ajax Metal Co., Philadelphia, Pa.
The Paul R. Brown Co., New York, N. Y.
A. W. Cadman Mfg. Co., Pittsburgh, Pa.—84
Colonial Supply Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Hoyt Metal Co., St. Louis, Mo.
Robert L. Latimer & Co., Philadelphia, Pa.
Lewistown Fdy. & Mch. Co., Lewistown, Pa.—331
Magnolia Metal Co., New York, N. Y.
Manning, Maxwell & Moore, Inc., New York, N. Y.
More-Jones Brass & Metal Co., St. Louis, Mo.
Premium Metal & Packing Co., Wilkinsburg, Pa.
Paul S. Reeves & Co., Philadelphia, Pa.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
United American Metals Corp., Brooklyn, N. Y.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—258-259

BACK FILLERS (Ditching Machines)

The American Cement Mch. Co., Inc., Keokuk, Ia.
American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
Baker Steel & Mchy. Co., Omaha, Nebr.
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
The Brown Hoisting Machy. Co., Cleveland, O.—280
The Byers Machine Co., Ravenna, O.—18
Continental Motors Corp., Detroit, Mich.
Erie Steam Shovel Co., Erie, Pa.—47
The Fundom Hoist & Shovel Co., Lima, O.
The Good Roads Machy. Co., Inc., Kennett Square, Pa.—61
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Harnischfeger Corp., Milwaukee, Wis.—gasoline—Insert bet. 8-9
Kensington Steel Co., Chicago, Ill.—parts
Keystone Driller Co., Beaver Falls, Pa.—297
The Marion Steam Shovel Co., Marion, O.—26-27
The Miami Trailer-Scraper Co., Troy, O.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Orton Crane & Shovel Co., Chicago, Ill.—81
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
The Star Drilling Machine Co., Akron, O.—253
Thaleg & Hock, Chicago, Ill.—33
Chas. T. Topping Mch. Co., Dayton, O.
The Universal Crane Co., Cleveland, O.

BAGS

The Adams Bag Co., Chagrin Falls, O.
Arkell Safety Bag Co., New York, N. Y.
Bates Valve Bag Co., Chicago, Ill.
Bemis Bro. Bag Co., St. Louis, Mo.
Chase Bag Co., Cleveland, O.
The Filter Fabrics Co., Salt Lake City, Utah.
Fulton Bag & Cotton Mills, Atlanta, Ga.
George & Sherrard Paper Co., Wellsburg, W. Va.
H. Goldman & Sons Co., Rochester, N. Y.

BAGS—Cont'd

Hammond Bag and Paper Co., Wellsburg, W. Va.
Interstate Bag Co., Walden, N. Y.—305
The Jaite Co., Jaite, O.—Inside back cover
Kennedy Car Liner & Bag Co., Shelbyville, Ind.
Miller, Tompkins & Co., New York, N. Y.
National Bag Co., Naperville, Ill.
The Penn Bag Co., Philadelphia, Pa.
Philadelphia Bag Co., Philadelphia, Pa.
Raymond Bag Co., Middletown, O.
Taggart Brothers Co., Watertown, N. Y.
The Valve Bag Co. of Amer., Toledo, O.—28-29
Western Valve Bag Co., Chicago, Ill.

BAG CLEANING, COUNTING AND BUNDLING MACHINERY

Anchor Concrete Mchy. Co., Adrian, Mich.—277
Besser Sales Co., Chicago, Ill.
The Century Bag Cleaning Co., Cincinnati, O.
The Faeberhill Mfg. Co., Cleveland, O.
The Republic Steel Package Co., Cleveland, O.
Western Valve Bag Co., Chicago, Ill.

BAGGING MACHINERY

Anchor Concrete Machy. Co., Adrian, Mich.—277
Bates Valve Bag Co., Chicago, Ill.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Ersted Mchy. Mfg. Co., Portland, Ore.
Gehret Bros., Inc., Bridgeport, Pa.
S. Howes Co., Inc., Silver Creek, N. Y.
H. Miscampbell, Duluth, Minn.—246-247
Modern Valve Bag Co., New York, N. Y.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Richardson Scale Co., Passaic, N. J.
Robinson Mfg. Co., Muncy, Pa.—cleaners
Union Special Mach. Co., Chicago, Ill.
The Valve Bag Co. of Amer., Toledo, O.—28-29
Western Engineering & Mfg. Co., Chicago, Ill.
Western Valve Bag Co., Chicago, Ill.

BAG TIES AND TYING TOOLS

Bates Valve Bag Co., Chicago, Ill.
Modern Valve Bag Co., New York, N. Y.

BALL BEARINGS (See Bearings, Anti-Friction)

BALLS (Grinding)

Coates Steel Products Co., Greenville, Ill.—227
Fuller-Lehigh Co., Fullerton, Pa.—78-79
The Jeffrey Mfg. Co., Columbus, O.—58-59
The Patterson Fdry. & Machine Co., E. Liverpool, O.
Peru Foundry Co., Peru, Ind.
Sturtevant Mill Co., Boston, Mass.—85

BALLS (Tube Mill, Steel Iron, etc.)

Abbe Engineering Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
J. R. Alsing Engineering Co., New York, N. Y.
American Car and Foundry Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
Ann Arbor Foundry Co., Ann Arbor, Mich.
Auburn Ball Bearing Co., Rochester, N. Y.
Chrome Steel Works, Carteret, N. J.—74
Coates Steel Products Co., Greenville, Ill.—227
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardinge Co., New York, N. Y.—66-67
Kensington Steel Co., Chicago, Ill.
The Komnick Machinery Co., Detroit, Mich.—278 and 301
Los Angeles Foundry Co., Los Angeles, Calif.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Manitowoc Eng. Works, Manitowoc, Wis.—293
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Patterson Fdy. & Mch. Co., E. Liverpool, O.
Peru Foundry Co., Peru, Ind.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Steacy-Schmidt Mfg. Co., York, Pa.
Sturtevant Mill Co., Boston, Mass.—85
Tioga Steel & Iron Co., Philadelphia, Pa.

BARGES

American Car and Foundry Co., New York, N. Y.
The Bucyrus Co., South Milwaukee, Wis.—steel—insert bet. 232-233
Manitowoc Eng. Works, Manitowoc, Wis.—293
Midland Barge Co., Midland, Pa.—steel
H. J. Miller Lumber Co., Seattle, Wash.—fir

BARRELS

The Cleveland Steel Barrel Co., Cleveland, O.
Draper Mfg. Co., Cleveland, O.
Ideal Concrete Machinery Co., Cincinnati, O.—tumbling—239
International Cooperage Co., Niagara Falls, N.Y.,—tongued and grooved—293
Knapp Metal Barrel & Package Co., San Francisco, Calif.
Manitowoc Eng. Works, Manitowoc, Wis.—293
Mullins Body Corp., Salem, O.
The Ohio Corrugating Co., Warren, O.—steel
The Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh Steel Drum Co., Pittsburgh, Pa.—295
Pressed Steel Tank Co., Milwaukee, Wis.
The Sandusky Coop. & Lbr. Co., St. Louis, Mo.
D. H. Stoll Co., Buffalo, N. Y.—steel

BARS AND RODS

Bethlehem Steel Co., Bethlehem, Pa.
Biehl Iron Works, Inc., Reading, Pa.
Central Frog & Switch Co., Cincinnati, O.—302
L. B. Foster Co., Pittsburgh, Pa.—302
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

BATCHERS

(See Aggregate Batchers)

BATTERY CHARGERS

Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49

BEARINGS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.
Auburn Ball Bearing Co., Rochester, N. Y.
Baker Car Co., Harriman, Tenn.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Coe Manufacturing Co., Painesville, O.
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.—roller hanger
Easton Car & Construction Co., Easton, Pa.—10
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Fafnir Bearing Co., New Britain, Conn.—ball—Insert bet. 2-3
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Gurney Ball Bearing Co., Jamestown, N. Y.
The Hanson Clutch & Machinery Co., Tiffin, O.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Hyatt Roller Bearing Co., Newark, N. J.—all types—12-13
Jeffrey Mfg. Co., Columbus, O.—58-59
Johnson Bronze Co., New Castle, Pa.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Lobdell Car Wheel Co., Wilmington, Del.—car
Manitowoc Eng. Works, Manitowoc, Wis.—293
The Medart Co., St. Louis, Mo.
More-Jones Brass & Metal Co., St. Louis, Mo.
Morgan Eng. Co., Alliance, O.
W. F. Mosser & Son, Allentown, Pa.
New Departure Mfg. Co., Bristol, Conn.—anti-friction
Norma-Hoffman Bearings Corp., Stamford, Conn.—ball, roller, thrust, anti-friction
Palmer-Bee Co., Detroit, Mich.—6
A. Plamondon Mfg. Co., Chicago, Ill.
Paul S. Reeves & Co., Inc., Philadelphia, Pa.—bronze, phosphor bronze
The Reeves Bros. Co., Alliance, O.
Robinson Mfg. Co., Muncy, Pa.
Roller Bearing Company of America, Newark, N. J.—flexible roller
Rollway Bearing Company, Inc., Syracuse, N. Y.
S. K. F. Co., New York, N. Y.
Standard Steel & Bearings Co., Plainville, Conn.
Stewart Mfg. Corp., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.—roller, tapered, thrust—229
The Transmission Ball Bearing Co., Buffalo, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.—flexible roller—262-263
The Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Inc., Joplin, Mo.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259
T. B. Wood's Sons Co., Chambersburg, Pa.—233

BEARINGS (Anti-Friction)

Auburn Ball Bearing Co., Rochester, N. Y.
Fafnir Bearing Co., New Britain, Conn.—ball—Insert bet. 2-3
Gurney Ball Bearing Co., Jamestown, N. Y.
Hyatt Roller Bearing Co., Newark, N. J.—12-13
The New Departure Mfg. Co., Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Newark, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S. K. F. Company, New York, N. Y.
Standard Steel & Bearings Co., Plainville, Conn.
The Transmission Ball Bearing Co., Buffalo, N. Y.
Timken Roller Bearing Co., Canton, O.—roller, tapered, thrust—229
T. B. Wood's Sons Co., Chambersburg, Pa.—233

BELT CONVEYORS

(See Conveyors)

BELT DRESSING

Alexander Bros., Philadelphia, Pa.
Cling-Surface Co., Buffalo, N. Y.
Crescent Belt Fastener Co., New York, N. Y.—92

BELT DRESSING—Cont'd

The Druid Oak Belting Co., Inc., Baltimore, Md.
Gandy Belting Co., Baltimore, Md.
Graton & Knight Mfg. Co., Worcester, Mass.
Robert L. Latimer & Co., Philadelphia, Pa.
Main Belting Co., Philadelphia, Pa.
Mount Vernon Belting Co., Baltimore, Md.
J. E. Rhoads & Sons, Philadelphia, Pa.
Chas. A. Schieren Co., New York, N. Y.
Sero Specialty Co., Cleveland, O.
Stephenson Mfg. Co., Albany, N. Y.
Texas Co., New York, N. Y.
Tidewater Oil Sales Corp., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.
United State Rub. Co., New York, N. Y.—231

BELT FASTENERS, HOOKS, RIVETS

Angell Belt Hook Co., Providence, R. I.
Bourne-Fuller Co., Unionville, Conn.—281
The Bristol Co., Waterbury, Conn.—metal
Crescent Belt Fastener Co., New York, N. Y.—92
Clipper Belt Lacer Co., Grand Rapids, Mich.
Detroit Belt Lacer Co., Detroit, Mich.
Flexible Steel Lacing Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Robert L. Latimer & Co., Philadelphia, Pa.
Main Belting Co., Philadelphia, Pa.
Thacher Belt Hook Co., Pawtucket, R. I.
Victor Balata & Textile Belting Co., New York, N. Y.
T. B. Wood's Sons Co., Chambersburg, Pa.—233

BELT LACING

Alexander Bros., Philadelphia, Pa.
The Bristol Co., Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Crescent Belt Fastener Co., New York, N. Y.—92
Detroit Belt Lacer Co., Detroit, Mich.
The Druid Belting Co., Inc., Baltimore, Md.
Flexible Steel Lacing Co., Chicago, Ill.
The Graton & Knight Mfg. Co., Worcester, Mass.
E. F. Houghton & Co., Philadelphia, Pa.
Robert L. Latimer & Co., Philadelphia, Pa.
National Leather Belting Co., New York, N. Y.
J. E. Rhoads & Son, Philadelphia, Pa.
Chas. A. Schieren Co., New York, N. Y.

BELT PROTECTORS

Doolittle-Stephens, Ltd., Hagerville, Ont., Can.

BELT RIVETS

(See Belt Fasteners, Hooks, Rivets)

BELT TIGHTENERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
H. W. Caldwell & Son Co., Chicago, Ill.—303
Easton Car & Construction Co., Easton, Pa.—10
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Hill Clutch Machine & Foundry Co., Cleveland, O.—plain and automatic—302
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Palmer-Bee Co., Detroit, Mich.—6
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
F. L. Smidth & Co., New York, N. Y.—69-70-71
Watson-Flagg Eng. Co., Paterson, N. J.—278
T. B. Wood's Sons Co., Chambersburg, Pa.—233

BELTING (Conveying, Transmission)

Akron Belting Co., Akron, O.—leather
Alexander Bros., Philadelphia, Pa.
The Allied Belting Co., Greenville, O.
Boston Woven Hose & Rubber Co., Boston, Mass.
Buffalo Weaving & Belt. Co., Buffalo, N. Y.
Burr Oak Belting Co., Cincinnati, O.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Cincinnati Rub. Mfg. Co., Cincinnati, O.—235
Corns Conveyor Belt Co., Chicago, Ill.
Diamond Rubber Co., Akron, O.
R. & J. Dick Co., Inc., Passaic, N. J.—Balata
Dodge Mfg. Co., Mishawaka, Ind.
Druid Oak Belting Co., Inc., Baltimore, Md.
Evansville Leather & Belting Co., Evansville, Ind.
Fabreeka Belting Co., Boston, Mass.
Gandy Belting Co., Baltimore, Md.
B. F. Goodrich Rubber Co., Akron, O.—all kinds—Insert bet. 4-5
The Goodyear Tire & Rubber Co., Inc., Akron, O.—all kinds
The Graton & Knight Mfg. Co., Worcester, Mass.
The Greenville Mfg. Co., Greenville, O.
Hettrick Mfg. Co., Toledo, O.—canvas
E. F. Houghton & Co., Philadelphia, Pa.
Howe Chain Co., Muskegon, Mich.—chain and link
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.—conveyors and chain—58-59
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—canvas, leather, rubber and chain—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.

BELTING—Cont'd

Main Belting Co., Philadelphia, Pa.
Manheim Belting & Mfg. Co., Manheim, Pa.
The Manhattan Rubber Mfg. Co., Passaic, N. J.
The McIlroy Belting & Hose Co., Hammond, Ind.
Morse Chain Co., Ithaca, N. Y.—chain—62
Mullins Body Corp., Salem, O.
Murray Rubber Co., Trenton, N. J.
National Leather Belting Co., New York, N. Y.
N. Y. Belting & Packing Co., New York, N. Y.
New York Rubber Co., New York, N. Y.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Palmer-Bee Co., Detroit, Mich.—6
Quaker City Rubber Co., Philadelphia, Pa.
Republic Belting Co., Baltimore, Md.
The Republic Rubber Co., Youngstown, O.
Robins Conveying Belt Co., New York, N. Y.—conveyor, elevator—249
Robinson Mfg. Co., Muncy, Pa.
J. E. Rhoads & Sons, Philadelphia, Pa.—leather
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.
W. H. Salisbury & Co., Inc., Chicago, Ill.
Sandvik Steel, Inc., New York, N. Y.—steel conveying
Chas. A. Schieren Co., New York, N. Y.—leather
Sprout, Waldron & Co., Muncy, Pa.—298
Stanley Belting Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.—conveyor—95
Sturtevant Mill Co., Boston, Mass.—chain transmission—85
Thermoid Rubber Co., Trenton, N. J.
Union Chain & Mfg. Co., Sandusky, O.
Union Engineering Co., Cleveland, O.—chain
United States Rubber Co., New York, N. Y.—231
Upson-Walton Co., Cleveland, O.
Victor Balata & Textile Co., New York, N. Y.
The Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237

BIN GATES

(See Gates, Bin)

BINS (Storage)

Acme Road Machinery Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.
Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—36
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
The Biehl Iron Works, Inc., Reading, Pa.
Bland Eng. Co., Minneapolis, Minn.—concrete
Blaw-Knox Co., Pittsburgh, Pa.—proportioning—60
Brown Hoisting Mchy. Co., Cleveland, O.—280
Burrell Eng. & Const. Co., Chicago, Ill.—295
Butler Bin Co., Waukesha, Wis.—steel
H. W. Caldwell & Sons Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., St. Louis, Mo.
Concrete Silo Co., Bloomfield, Ind.
Conveyors Corp. of America, Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Pa.
Easton Car & Construction Co., Easton, Pa.—10
Erie Steel Construction Co., Erie, Pa.
The Galion Iron Works & Mfg. Co., Galion, O.
Good Roads Mchy. Co., Kennett Square, Pa.—61
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—rock, gravel, portable—245
Guarantee Construction Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Heltzel Steel Form & Iron Co., Warren, O.—65
Wilbur G. Hudson Corp., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.—portable—41
Jackson & Church Co., Saginaw, Mich.—257
The Jeffrey Mfg. Co., Columbus, O.—58-59
The Kirk & Blum Mfg. Co., Cincinnati, O.—steel
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.—steel
MacDonald Engineering Co., Chicago, Ill.—cement and gypsum—298
McGann Mfg. Co., York, Pa.—254
Manitowoc Eng. Works, Manitowoc, Wis.—293
H. Miscampbell, Duluth, Minn.—246-247
Northern Blower Co., Cleveland, O.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Petroleum Iron Wks. Co. of Ohio, Sharon, Pa.
The Reeves Bros. Co., Alliance, O.
Roberts & Schaefer Co., Chicago, Ill.—25
James B. Seaverns Co., Chicago, Ill.
The Spencer Construction Co., Baltimore, Md. (Eastern Division—MacDonald Eng. Co.)
Sprout, Waldron & Co., Muncy, Pa.—298
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
The Sykes Co., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

BINS—Cont'd

The Union Engineering Co., Cleveland, O.
Universal Crusher Co., Cedar Rapids, Ia.—276
Universal Road Mchy. Co., Kingston, N. Y.—300
Ralph A. Watson Co., Anaconda, Mont.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wiederholt Construction Co., St. Louis, Mo.
Wisconsin Bridge & Iron Works, N. Milwaukee, Wis.
Youngstown Boiler & Tank Co., Youngstown, O.

BLAST HOLE DRILLS

(See Drills)

BLASTING ACCESSORIES

American Blower Co., Detroit, Mich.
Atlas Powder Co., Wilmington, Del.
Colonial Supply Co., Pittsburgh, Pa.
E. I. Du Pont de Nemours & Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.—48
General Explosives Co., Chicago, Ill.
The Giant Powder Co., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.—52
Hercules Powder Co., Wilmington, Del.—37
Illinois Powder Mfg. Co., St. Louis, Mo.
Littleford Bros., Cincinnati, O.
Trojan Powder Co., Allentown, Pa.

BLASTING POWDER

(See Explosives)

BLOCK MACHINERY

(See Concrete Products Machinery)

BLOCKS

American Hoist & Derrick Co., St. Paul, Minn.—wire rope—298
Beach Mfg. Co., Charlotte, Mich.—sheave
H. W. Caldwell & Son Co., Chicago, Ill.—pillow—303
Jas. H. Channon Mfg. Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
The O. H. Davidson Equip. Co., Denver, Colo.
R. & J. Dick Co., Inc., Passaic, N. J.—pillow
Dobbie Fdy. & Mch. Co., Niagara Falls, N. Y.
Dodge Manufacturing Corp., Mishawaka, Ind.—pillow, roller bearings, plain and self-oiling
Hanson Clutch & Machy. Co., Tiffin, O.—pillow
The Hill Clutch Machine & Foundry Co., Cleveland, O.—pillow, heavy duty, plain, grease, collar, oiling and cutless rubber—302
Hyatt Roller Bearing Co., Newark, N. J.—pillow, roller bearing—12-13
A. Leschen & Sons Rope Co., St. Louis, Mo.—Inside back cover
Link-Belt Co., Chicago, Ill.—pillow—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Cal.—pillow
Macwhyte Co., Kenosha, Wis.
The Medart Co., St. Louis, Mo.—pillow
Mining Machine Co., Mountville, Pa.—steel sheave
A. Plamondon Mfg. Co., Chicago, Ill.—pillow
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Sauerman Bros., Chicago, Ill.—sheave—256
Timken Roller Bearing Co., Canton, O.—pillow and roller bearing—229
Upson-Walton Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.—pillow
Weller Mfg. Co., Chicago, Ill.—237
T. B. Wood's Sons Co., Chambersburg, Pa.—pillow—233
Yale & Towne Mfg. Co., Stamford, Conn.—chain

BLOCKS, FRICTION (Asbestos)

Thomas L. Gatke, Chicago, Ill.—45

BLOWING AND SUCTION DEVICES

American Blower Co., Detroit, Mich.
American Gas Furnace Co., Elizabeth, N. J.
The Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Clarage Fan Co., Kalamazoo, Mich.
Clements Mfg. Co., Chicago, Ill.
Connersville Blower Co., Connersville, Ind.
Continental Motors Corp., Detroit, Mich.
DeLaval Steam Turbine Co., Trenton, N. J.—centrifugal blowers—63
Dust Recovering & Conveying Co., Cleveland, O.
Electric Blower Co., Boston, Mass.
Electric Vacuum Cleaner Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.—58-59
The Kirk & Blum Mfg. Co., Cincinnati, O.
The Manitowoc Engineering Works, Manitowoc, Wis.—blow pipe—293
The Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Ridgway Dynamo & Engine Co., Cleveland, O.—centrifugal blowers
The P. H. & J. M. Roots Co., Connersville, Ind.
B. F. Sturtevant Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

BLOW TORCHES, HEATERS, THAWING OUTFITS, SNOW MELTERS AND BRAZING OUTFITS

Aeroil Burner Co., Inc., Union City, N. J.
Air Reduction Sales Co., New York, N. Y.
American Blower Co., Detroit, Mich.
Champion Blower & Forge Co., Lancaster, Pa.
Colonial Supply Co., Pittsburgh, Pa.
Cutler-Hammer Co., Milwaukee, Wis.—49
Easton Car & Construction Co., Easton, Pa.—10
Hauck Mfg. Co., Brooklyn, N. Y.
Haynes Stellite Co., New York, N. Y.—also blowpipes
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
The Linde Air Products Company, New York, N. Y.—also blowpipes.
Littleford Bros., Cincinnati, O.
The MacLeod Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Alexander Milburn Co., Baltimore, Md.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Oxweld Acetylene Co., New York, N. Y.—also blowpipes—4
The Prest-O-Lite Co., New York, N. Y.—also blowpipes.
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Universal Road Mchy. Co., Kingston, N. Y.—300
Weldit Acetylene Co., Detroit, Mich.

BODIES (Commercial Car)
(See Truck Bodies)

BOILERS

Babcock & Wilcox, New York, N. Y.
Bethlehem Ship Building Corp., San Francisco, Cal.
The Biehl Iron Works, Inc., Reading, Pa.
Bigelow Company, New Haven, Conn.
The Brownell Co., Dayton, O.
Brunswick-Kroeschell Co., Brunswick, N. J.
Casey-Hedges Co., Chattanooga, Tenn.
Clyde Iron Wks., Duluth, Minn.—vertical, tubular
Coatesville Boiler Works, Coatesville, Pa.
D. Connelley Boiler Co., Cleveland, O.
Davenport Locomotive Works, Davenport, Ia.
J. F. Davis Co., Chicago, Ill.
Edge Moor Iron Co., Edge Moor, Del.—heating, waste heat and water tube—57
Erie City Iron Works, Erie, Pa.
Freeman Mfg. Co., Racine, Wis.
Heine Boiler Co., St. Louis, Mo.—water tube, all types
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Hyde & Co., Pittsburgh, Pa.—water tube
Jackson & Church Co., Saginaw, Mich.—water tube—257
E. Keeler Co., Williamsport, Pa.
The Komnick Machinery Co., Detroit, Mich.—water tube—278 and 301
Ladd Water Tube Boiler Co., Pittsburgh, Pa.—water tube
La Mont Corp., New York, N. Y.
Manitowoc Eng. Works, Manitowoc, Wis.—293
The Mine & Smelter Supply Co., New York, N. Y.—Inside back cover
Murray Iron Wks. Co., Burlington, Ia.—all types
Oil City Boiler Works, Oil City, Pa.
Orr & Sembower, Reading, Pa.—all types
W. H. Page Boiler Co., New York, N. Y.
Page Water Tube Boiler Co., Chicago, Ill.
Ross Power Equipment Co., Indianapolis, Ind.
Ruston & Hornsby, Ltd., Lincoln, England—all types
Southwestern Eng. Corp., Los Angeles, Calif.—water tube
Springfield Boiler Co., Springfield, Ill.
Steacy-Schmidt Mfg. Co., York, Pa.
Titusville Iron Works Co., Titusville, Pa.
Henry Vogt Machine Co., Louisville, Ky.
The Walsh & Weidner Boiler Co., Chattanooga, Tenn.
The Wickes Boiler Co., Saginaw, Mich.—vertical water tube, horizontal cross drum, horizontal return tubular
Youngstown Boiler & Tank Co., Youngstown, O.

BOILER COMPOUND

Dearborn Chemical Co., Chicago, Ill.
Johns-Manville, Inc., New York, N. Y.
North American Fibre Products Co., Cleveland, O.
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Scientific Boiler Chemical Works, Chicago, Ill.
Sero Specialty Co., Cleveland, O.

BOILER INSULATION

Celite Products Co., Los Angeles, Calif.—279

BOILER MOUNTINGS

The Lunkenheimer Co., Cincinnati, O.—299

BOILER TUBES

Babcox & Wilson Tube Co., Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass Co., Waterbury, Conn.—capper
Hyde & Co., Pittsburgh, Pa.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.

BOX CAR LOADERS
(See Loaders, Unloaders)

BRACES (Rail and Track)

T. H. Edelblute Co., Pittsburgh, Pa. —301
Morrison & Risman, Buffalo, N. Y.

BRAKE BLOCKS (Asbestos)

Thomas L. Gatke, Chicago, Ill.—45

BRAKE LININGS

Thomas L. Gatke, Chicago, Ill.—asbestos—45
Johns-Manville, Inc., New York, N. Y.—asbestos
Manhattan Rubber Mfg. Co., Passaic, N. J.—for all industrial purposes
Thermoid Rubber Co., Trenton, N. J.—for cranes, dredges and hoists.

BRAKES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—magnetic—49
Electric Controller & Mfg. Co., Cleveland, O.—electric.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Safety First Supply Co., Pittsburgh, Pa.
Wehr Company, Milwaukee, Wis.—for Fordson tractors
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

BRASS FOUNDRY EQUIPMENT

J. W. Paxson Co., Philadelphia, Pa.—50-51

BREECHINGS

Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
The Kirk & Blum Mfg. Co., Cincinnati, O.
Littleford Bros., Cincinnati, O.
Manitowoc Eng. Works, Manitowoc, Wis.—293

BRICK (Insulating)

Celite Products Co., Los Angeles, Calif.—279
General Refractories Co., Philadelphia, Pa.—335

BRICK (SAND-LIME) HARDENING CYLINDERS

Jackson & Church Co., Saginaw, Mich.—257
Komnick Machy. Co., Detroit, Mich.—278, 301

BRICK DRYING CARS

Besser Sales Co., Chicago, Ill.
H. D. Conkey & Co., Mendota, Ill.
Easton Car & Construction Co., Easton, Pa.—10
Egyptian Iron Works, Murphysboro, Ill.
Jackson & Church Co., Saginaw, Mich.—257
Komnick Mchy. Co., Detroit, Mich.—278, 301
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Dr. Bernhardi Sohn, Eilenburg, Germany

BRICK LOADING APPARATUS

Komnick Machy. Co., Detroit, Mich.—278, 301

BRICK MACHINERY

American Manganese Steel Co., Chicago, Heights, Ill.—parts
Anchor Concrete Mchy. Co., Adrian, Mich.—277
Besser Sales Co., Chicago, Ill.—concrete
The Bonnot Co., Canton, O.—248
Concrete Equipment Co., Holland, Mich.—concrete
The Deister Concentrator Co., Fort Wayne, Ind.—299
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Helm Brick Machine Co., Cadillac, Mich.—concrete
A. J. Heskett Concrete Machy. Co., Williamsport, Pa.—68
Ideal Concrete Machinery Co., Cincinnati, O.—concrete—239
Jackson & Church Co., Saginaw, Mich.—sand-lime—257
Kensington Steel Co., Chicago, Ill.—parts
Komnick Machinery Co., Detroit, Mich.—sand-lime—278, 301
Lancaster Iron Works, Inc., Lancaster, Pa.
Mackintosh - Hemphill Co., Pittsburgh, Pa.—wearing parts—290
Shope Brick Co., Portland, Ore.—concrete
Dr. Bernhardi Sohn, Eilenburg, Germany
L. V. Thayer, New York, N. Y.—concrete, cement
Zagelmeyer Cast Stone Block Machy. Co., Bay City, Mich.—305

BRICK PRESSES

Anchor Concrete Machy. Co., Adrian, Mich.—277
Anderson Engine & Foundry Co., Anderson, Ind.
Besser Sales Co., Chicago, Ill.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Helm Brick Machine Co., Cadillac, Mich.
Jackson & Church Co., Saginaw, Mich.—257
Komnick Mchy. Co., Detroit, Mich.—278, 301
Shope Brick Co., Portland, Ore.
L. V. Thayer, New York, N. Y.
Dr. Bernhardi Sohn, Eilenburg, Germany.

BUCKET CONVEYORS
(See Conveyors and Elevators)

BUCKETS
(Clamshell, Orangepeel, Dragline, Grab)

American Car and Fdy. Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
Atlas Car & Mfg. Co., Cleveland, O.—260
Bay City Dredge Works, Bay City, Mich.
Beach Mfg. Co., Charlotte, Mich.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Blaw-Knox Co., Pittsburgh, Pa.—clamshell—60
Brown Hoisting Mchy. Co., Cleveland, O.—280
The Browning Crane Co., Cleveland, O.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—18
The Dayton Whirley Co., Dayton, O.
Easton Car & Construction Co., Easton, Pa.—10
Erie Steel Construction Co., Erie, Pa.
Forsythe Bros., New York, N. Y.
L. B. Foster Co., Pittsburgh, Pa.—88
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Hayward Co., New York, N. Y.—also dredging—11
Hendrick Mfg. Co., Carbondale, Pa.—306
Industrial Works, Bay City, Mich.—all excepting orangepeels
Joshua Hendy Iron Works, San Francisco, Cal.
Jos. F. Kiesler Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
The Lakewood Engineering Co., Cleveland, O.
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.
Manitowoc Eng. Works, Manitowoc, Wis.—293
Marion Steam Shovel Co., Marion, O.—26-27
McMyler-Interstate Co., Cleveland, O.—40
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Northwest Eng. Co., Chicago, Ill.—Insert bet. 2-3
Orton Crane & Shovel Co., Chicago, Ill.—81
Osgood Co., Marion, O.—301
Owen Bucket Co., Cleveland, O.—93
Page Eng. Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
J. W. Paxson Co., Philadelphia, Pa.—50-51
Ross Power Equipment Co., Indianapolis, Ind.
Sauerman Bros., Inc., Chicago, Ill.—256
James B. Seaverns Co., Chicago, Ill.
The Star Drilling Machine Co., Akron, O.—253
Thaleg & Hock, Chicago, Ill.—33
The Thew Shovel Co., Lorain, O.—Insert bet. 80-81
Universal Crane Co., Cleveland, O.
The Wellman-Seaver-Morgan Co., Cleveland, O.
G. H. Williams Co., Erie, Pa.

BUCKETS (Elevator and Conveyor)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Heights, Ill.
Atlas Car & Mfg. Co., Cleveland, O.—260
Austin Machinery Corp., Toledo, O.
Earle C. Bacon, Inc., New York, N. Y.—275
Baker Car Co., Harriman, Tenn.
Beach Mfg. Co., Charlotte, Mich.
Besser Sales Co., Chicago, Ill.
Biehl Iron Works, Inc., Reading, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.—280
C. O. Bartlett & Snow Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Columbian Steel Tank Co., Kansas City, Mo.
Columbus Conveyor Co., Columbus, O.
Conveyor Corp. of America, Chicago, Ill.
Cross Eng. Co., Carbondale, Pa.—273
Dodge Mfg. Corp., Mishawaka, Ind.
Doolittle-Stephens, Ltd., Hagersville, Ont., Can.
Easton Car & Construction Co., Easton, Pa.—10
Ellicott Machine Corp., Baltimore, Md.
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Forsythe Bos., New York, N. Y.
The Galion Iron Wks. & Mfg. Co., Galion, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Mchy. Co., Kennett Square, Pa.—61
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.—306
Hesse-Ersted Iron Works, Portland, Ore.
Howe Chain Co., Muskegon, Mich.
S. Howes Co., Silver Creek, N. Y.
Hunt Co., C. W., Staten Island, N. Y.
Inland Engineering Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.

BUCKETS (Elevator and Conveyor)—Cont'd

Koppel Industrial Car& Equip. Co., Koppel, Pa.—284
The Lakewood Engineering Co., Cleveland, O.
Robert L. Latimer & Co., Philadelphia, Pa.
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.
Logan Co., Louisville, Ky.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
McLanahan Stone Machine Co., Hollidaysburg, Pa.—272
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
George W. Moore Co., Chicago, Ill.
Moore & Moore, Inc., Reading, Pa.
The Morrow Mfg. Co., Columbus, O.
Mullins Body Corp., Salem, O.
New Holland Machine Co., New Holland, Pa.—283
The Owen Bucket Co., Cleveland, O.—93
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Foundry & Mfg. Co., Reading, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
James B. Seaverns Co., Chicago, Ill.
T. L. Smith Co., Milwaukee, Wis.
Smith Eng. Works, Milwaukee, Wis.—283
Sprout, Waldron & Co., Muncy, Pa.—298
Standard Steel Works, North Kansas City, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—steel and cast iron—95
The Sykes Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Eng. & Mfg. Ci., Allentown, Pa.—262-263
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wellman-Seaver-Morgan Co., Cleveland, O.
Union Chain & Mfg. Co., Sandusky, O.
The Union Engineering Co., Cleveland, O.
United Iron Works, Joplin, Mo.

BUCKETS (Self-Dumping)

Biehl Iron Wks., Reading, Pa.
Clyde Iron Wks., Duluth, Minn.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Penn Foundry & Mfg. Co., Reading, Pa.

BUCKETS (Skip)

Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manitowoc Eng. Works, Manitowoc, Wis.—293
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
Chain Belt Co., Milwaukee, Wis.—96
The Galion Iron Works & Mfg. Co., Galion, O.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Penn Foundry & Mfg. Co., Reading, Pa.
The Webster Mfg. Co., Chicago, Ill.

BUHR MILLS

Butterworth & Lowe, Grand Rapids, Mich.—300
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Munson Mill Machy. Co., Utica, N. Y.
Robinson Mfg. Co., Muncy, Pa.
Sturtevant Mill Co., Boston, Mass.—85
The Patterson Fdy. & Mch. Co., E. Liverpool, O.

BUHR STONES

J. R. Alsing Eng. Co., Inc., New York, N. Y.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Munson Mill Machinery Co., Utica, N. Y.
Robinson Mfg. Co., Muncy, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298

BUILDING CONSTRUCTORS

Bland Engineering Co., Minneapolis, Minn.
Blaw-Knox Co., Pittsburgh, Pa.—60
Bollinger-Andrews Con. Co., Pittsb'gh, Pa.—304
Burrell Eng. & Const. Co., Chicago, Ill.—295
The H. K. Ferguson Co., Cleveland, O.—232
H. Miscampbell, Duluth, Minn.—246-247
Morgan Eng. Co., Alliance, O.
Roberts & Schaefer Co., Chicago, Ill.—25
James B. Seaverns Co., Chicago, Ill.
Southwestern Engineering Co., Los Angeles, Calif.
Standard Erecting Corp., New York, N. Y.
The Stearns-Roger Mfg. Co., Denver, Colo.
Truscon Steel Co., Youngstown, O.
Ralph A. Watson Co., Anaconda, Mont.
The Wellman-Seaver-Morgan Co., Cleveland, O.
Wisconsin Bridge & Iron Co., N. Milwaukee, Wis.

BUILDINGS

Blaw-Knox Co., Pittsburgh, Pa.—60
Columbian Steel Tank Co., Kansas City, Mo.
H. K. Ferguson Co., Cleveland, O.—232
Littleford Bros., Cincinnati, O.—portable
Truscon Steel Co., Youngstown, O.
Wisconsin Bridge & Iron Co., No. Milwaukee, Wis.—portable

CABLE

American Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—302
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Broderick & Bascom Rope Co., St. Louis, Mo.—46
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Mfg. Corp., Mishawaka, Ind.
Hazard Mfg. Co., Wilkes-Barre, Pa.
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302.
A. Leschen & Sons Rope Co., St. Louis, Mo.—Inside back cover
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Standard Underground Cable Co., Pittsburgh, Pa.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—86

CABLE (Manila Drilling)

(See Rope, Manila)

CABLE LOCOMOTIVES

(See Locomotives, Cable)

CABLEWAYS

American Mfg. & Eng. Co., Kalamazoo, Mich.
American Steel & Wire Co., Chicago, Ill.—302
Bedford Fdry. & Mach. Co., Bedford, Ind.
Blaw-KnoxCo., Pittsburgh, Pa.—automatic single rope—60
Broderick & Bascom Rope Co., St. Louis, Mo.—46
Clyde Iron Works, Duluth, Minn.
Easton Car & Construction Co., Easton, Pa.—10
S. Flory Mfg. Co., Bangor, Pa.—304
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Godfrey Conveyor Co., Elkhart, Ind.
Hazard Mfg. Co., Wilkes-Barre, Pa.—electric
Joshua Hendy Iron Works, San Francisco. Calif.
John T. Horton Co., Inc., New York, N. Y.
Interstate Equip. Corp., New York, N. Y.—24
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Macwhyte Co., Kenosha, Wis.
The Mundy Sales Corp., New York, N. Y.—16
Pioneer Bucket Co., Indianapolis, Ind.
Railway & Industrial Eng. Co., Greensburg, Pa.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Sauerman Bros., Chicago, Ill.—excavating, drag-line and slackline—256
Scofield-Burkett Construction Co., Macon, Ga.
Street Bros. Mach. Works, Chattanooga, Tenn.
Thomas Elevator Co., Chicago, Ill.—299

CALCINING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Process Co., New York, N. Y.—302
Arnold & Weigel, Woodville, O.—250-251
Atlas Car & Mfg. Co., Cleveland, O.—260
Bonnot Co., Canton, O.—248
Butterworth & Lowe, Grand Rapids, Mich.—300
L. R. Christie Co., Pittsburgh, Pa.
Colorado Iron Works Co., Denver, Colo.
J. P. Devine Co., Buffalo, N. Y.—kettles
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Kennedy-Van Saun Mfg. & Engineering Corp., New York, N. Y.
Louisville Drying Machy. Co., Louisville, Ky.—305
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—254
H. Miscampbell, Duluth, Minn.—246-247
Reeves Bros. Co., Alliance, O.
Ruggles-Coles Eng. Co., New York, N. Y.
Schaffer Eng. Co., Pittsburgh, Pa.
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Vulcan Iron Works, Wilkes-Barre, Pa.—89

CALCIUM CARBIDE

Air Reduction Sales Co., New York, N. Y.
Carbic Mfg. Co., Duluth, Minn.
Shawingan Products Corp., New York, N. Y.

CAPSTANS (See Winches)

CARBIDE

The Linde Air Products Co., New York, N. Y.

CAR UNLOADERS

(See Loaders, Unloaders)

CARRIERS

American Car and Foundry Co., New York, N. Y.
R. H. Beaumont Co., Philadelphia, Pa.
Chain Belt Co., Milwaukee, Wis.—96
H. D. Conkey & Co., Mendota, Ill.
Conveyor Corp. of America, Chicago, Ill.
Easton Car & Construction Co., Easton, Pa.—10
The Greenville Mfg. Co., Greenville, O.
Wilbur G. Hudson Corp., New York, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Vulcan Iron Works, Wilkes-Barre, Pa.—89
F. M. Welch Eng. Service, Greenville, O.—289

CAR DUMPERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Bay City Foundry & Mach. Co., Bay City, Mich.
Brown Hoisting Mchy. Co., Cleveland, O.—280
Fairmont Mining Machine Co., Fairmont, W. Va.
Fulton Iron Works Co., St. Louis, Mo.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The McMyler-Interstate Co., Cleveland, O.—40
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Roberts & Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
James B. Seaverns Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wellman-Seaver-Morgan Co., Cleveland, O.

CAR LINERS

See Paper (For Lining Cars)

CAR PULLERS

The Aldon Co., Chicago, Ill.
The American Hoist & Derrick Co., St. Paul, Minn.—298
Bethlehem Ship Building Corp., Bethlehem, Pa.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Clyde Iron Works, Duluth, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
S. Flory Mfg. Co., Bangor, Pa.—304
L. B. Foster Co., Inc., Pittsburgh, Pa.—88
Fridy Hoist & Machinery Co., Mountville, Pa.
The Godfrey Conveyor Co., Elkhart, Ind.
Hunt, C. W., Co., W. New Brighton, N. Y.
Hyman-Michaels Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Mining Machine Co., Mountville, Pa.
National Hoisting Engine Co., Harrison, N. J.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Ottumwa Iron Works, Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.—6
Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Thomas Elevator Co., Chicago, Ill.—299
Union Chain & Mfg. Co., Sandusky, O.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
The Wellman-Seaver-Morgan Co., Cleveland, O.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Komnick Machy. Co., Detroit, Mich.—278, 301
The Mundy Sales Corp., New York, N. Y.—16
Novo Engine Co., Lansing, Mich.—236
Robins Conveying Belt Co., New York, N. Y.—249
Sprout, Waldron & Co., Muncy, Pa.—298
Thaleg & Hock, Chicago, Ill.—33

CAR REPLACERS

Aldon Co., Chicago, Ill.
American Manganese Steel Co., Chicago Hts., Ill.
T. H. Edelblute Co., Pittsburgh, Pa.—301
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Track Equipment Co., Huntington, W. Va.

CAR TRUCKS

American Car and Fdy. Co., New York, N. Y.
The Atlas Car & Mfg. Co., Cleveland, O.—260
Baker Car Co., Harriman, Tenn.
Besser Sales Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brookville Locomotive Co., Brookville, Pa.—274
H. D. Conkey & Co., Mendota, Ill.—warehouse
Eagle Iron Works, Des Moines, Ia.—305
Easton Car & Construction Co., Easton, Pa.—10
Gustafson Mfg. Co., Chattanooga, Tenn.
Hockensmith Mine Car Co., Penn, Pa.
Komnick Mchy. Co., Detroit, Mich.—278, 301
Koppel Industrial Car & Equipment Co., Koppel, Pa.—284
Lakewood Engineering Co., Cleveland, O.
Lobdell Car Wheel Co., Wilmington, Del.

CAR TRUCKS—Cont'd

Ottumwa Iron Works, Ottumwa, Ia.—patented roller bearings
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Foundry & Mfg. Co., Reading, Pa.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Watt Mining Car Wheel Co., Barnesville, O.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

CARS

(Dump, Industrial, Quarry, Push, etc.)

Acme Road Machy. Co., Frankfort, N. Y.
American Car & Foundry Co., New York, N. Y.
Anchor Concrete Machy. Co., Adrian, Mich.—kiln—277
Atlas Car & Mfg. Co., Cleveland, O.—260
Austin Mfg. Co., Chicago, Ill.—36
Austin Western Road Mchy. Corp., Chicago, Ill.
Earle C. Bacon, New York, N. Y.—275
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Pa.
Biehl Iron Works, Inc., Reading, Pa.
Bloomsburg Locomotive Works, Bloomsburg, Pa.
The Buda Co., Harvey, Ill.
The C. S. Card Iron Works Co., Denver, Colo.
The Chase Fdy. & Mfg. Co., Columbus, O.
Columbian Steel Tank Co., Kansas City, Mo.
H. D. Conkey & Co., Mendota, Ill.
O. H. Davidson Equip. Co., Denver, Colo.
The Differential Steel Car Co., Findlay, O.
Enterprise Wheel & Car Corp., Bristol, Tenn.
Exeter Machine Works, Inc., West Pittston, Pa.
Fairmont Mining Machy. Co., Fairmont, W. Va.
Easton Car & Construction Co., Easton, Pa.—all types—10
Engineering Products Co., Chicago, Ill.
Fairbanks Mfg. Co., New York, N. Y.
Gehret Bros., Bridgeport, Pa.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—dump—61
Gruendler Patent Crusher & Pulv. Co., St. Louis, Mo.—245
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Heil Co., Milwaukee, Wis.
Joshua Hendy Iron Works, San Francisco, Calif.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Hyman-Michaels Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.—rocker dump
International Clay Machy. Co., Dayton, O.
Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kenova Mine Car Co., Kenova, W. Va.
Kentucky Wagon Mfg. Co., Louisville, Ky.
Komnick Mchy. Co., Detroit, Mich.—278, 301
Koppel Industrial Car & Equipment Co., Koppel, Pa.—all types—284
Lake Shore Engine Works, Marquette, Mich.
The Lakewood Engineering Co., Cleveland, O.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Magor Car Corp., New York, N. Y.
Manitowoc Eng. Works, Manitowoc, Wis.—293
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Ogden Iron Works Co., Ogden, Utah
Ottumwa Iron Works, Ottumwa, Iowa—pit
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Foundry & Mfg. Co., Readnig, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Sanford-Day Iron Works, Knoxville, Tenn.
James B. Seaverns Co., Chicago, Ill.
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Southern Wheel Co., St. Louis, Mo.
United Iron works, Inc., Joplin, Mo.
Watt Mining Car Wheel Co., Barnsville, O.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233
The Woodford Eng. Co., Chicago, Ill.—dump, electric, motor driven—Insert bet. 232-233

CARTS (Concrete, Dump)

Penn Foundry & Mfg. Co., Reading, Pa.
Western Wheeled Scraper Co., Aurora, Ill.—dump—Insert bet. 232-233

CASINGS (Elevator)
(Also see Elevators)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
H. W. Caldwell & Son Co., Chicago, Ill.—303
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Jackson & Church Co., Saginaw, Mich.—257
Jeffrey Mfg. Co., Columbus, O.—58-59
Robt. L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mackintosh - Hemphill Co., Pittsburgh, Pa.—adamite, iron and steel—290
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51

CASINGS—Cont'd

W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

CASTINGS

Advance Foundry Co., Dayton, O.—238
American Car and Foundry Co., New York, N. Y.
American Manganese Steel Co., Chicago Heights, Ill.—manganese
American Process Co., New York, N. Y.—302
Bedford Fdy. & Mach. Co., Bedford, Ind.—gray iron
Bethlehem Steel Co., Bethlehem, Pa.
Bonnot Co., Canton, O.—248
Bucyrus Co., South Milwaukee, Wis.—steel—Insert bet. 232-233
Burch Plow Works, Crestline, O.
A. W. Cadman Mfg. Co., Pittsburgh, Pa.—84
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Chicago Steel Foundry Co., Chicago, Ill.—steel
Chrome Steel Works, Carteret, N. J.—74
Colorado Iron Works, Denver, Colo.—manganese
Davenport Loco. Wks., Davenport, Ia.—gray iron
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Eagle Iron Works, Des Moines, Ia.—gray iron—305
Egyptian Iron Works, Murphysboro, Ill.
Electric Manganese Steel Co., Reading, Pa.—manganese
Enterprise Wheel & Car Co., Bristol, Tenn.
Erie City Iron Works, Erie, Pa.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
The Falk Corp., Milwaukee, Wis.—Insert bet. 232-233
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
The Frog, Switch & Mfg. Co., Carlisle, Pa.—manganese
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Fulton Iron Works Co., St. Louis, Mo.
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—manganese—271 and 300
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Machine & Foundry Co., Cleveland, O.—gray iron, semi-steel—302
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.—gray iron
Hubbard Steel Foundry Co., East Chicago, Ind.
Indiana Foundry Co., Inc., Indiana, Pa.
Jackson & Church Co., Saginaw, Mich.—257
Jeffrey Mfg. Co., Columbus, O.—malleable—58-59
W. A. Jones Fdry. & Mach. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kenova Mine Car Co., Kenova, W. Va.
Kensington Steel Co., Chicago, Ill.—manganese and alloy steel
Kramer Bros. Foundry Co., Dayton, O.
Lewis Foundry & Machine Co., Pittsburgh, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calfi.
Lobdell Car Wheel Co., Wilmington, Del.
Los Angeles Foundry Co., Los Angeles, Calif.
Louisville Drying Machy. Co., Louisville, Ky.—305
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—gray iron and semi-steel—254
The McLanahan Stone Machine Co., Hollidaysburg, Pa.—272
The McMyler-Interstate Co., Cleveland, O.—40
Midvale Co., Nicetown, Philadelphia, Pa.—54
Minneapolis Steel & Machy Co., Minneapolis, Minn.
Moore & Moore, Inc., Reading, Pa.—manganese
More-Jones Brass & Metal Co., St. Louis, Mo.
Morgan Engineering Co., Alliance, O.
Munson Mill Machinery Co., Inc., Utica, N. Y.
Murray Iron Works Co., Burlington, Iowa
National Malleable & Steel Castings Co., Cleveland, O.—malleabe, steel
Nortmann-Duffke Co., Milwaukee, Wis.—gray iron
Novo Engine Co., Lansing, Mich.—236
Penn Foundry & Mfg. Co., Reading, Pa.
Pennsylvania Casting & Mch. Co., Pittsburgh, Pa.
Pettibone-Mulliken Co., Chicago, Ill.—manganese
Philadelphia Steel & Iron Co., Philadelphia, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Eng. & Machine Co., Baltimore, Md.
Reading Steel Casting Co., Inc., Bridgeport, Conn.
Paul S. Reeves & Co., Inc., Philadelphia, Pa.—brass.
Reeves Bros. Co., Alliance, O.
Robins Conveying Belt Co., New York, N. Y.—249
Ruggles-Coles Eng. Co., New York, N. Y.—gray iron
Sivyer Steel Casting Co., Milwaukee, Wis.—steel
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
Stewart Mfg. Corp., Chicago, Ill.—die
H. N. Strait Mfg. Co., Kansas City, Kans.

CASTINGS—Cont'd

Stroh Steel Hardening Process Co., Pittsburgh, Pa.
Superior Castings Co., Benton Harbor, Mich.
The Sykes Company, Chicago, Ill.—elevator
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel
Thaleg & Hock, Chicago, Ill.—33
Traylor Engineering & Mfg. Co., Allentown, Pa. 262-263
United Iron Works, Inc., Joplin, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.—iron and steel—89
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webb City & Carterville Foundry & Machine Co., Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.
Western Crucible Steel Casting Co., Minneapolis, Minn.—alloy and commercial steel—32
Worthington Pump and Machy. Corp., New York, N. Y.—Gray iron and semi-steel

CEMENT BRICK MACHINES
(See Brick Machines)

CEMENT BRIQUET MOLDS

Excelsior Tool & Mach. Co., E. St. Louis, Ill.
E. H. Sargent & Co., Chicago, Ill.

CEMENT, HIGH TEMPERATURE

Ashland Fire Brick Co., Ashland, Ky.
Betson-Jewell, Inc., Rome, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
Celite Products Co., Los Angeles, Calif.—279
Chicago Fire Brick Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
General Refractories Co., Philadelphia, Pa.—335
A. P. Green Fire Brick Co., Mexico, Mo.—73
Harbison-Walker Refractories Co., Pittsburgh, Pa.
The Ironton Fire Brick Co., Ironton, O.
Johns-Manville, Inc., New York, N. Y.
Laclede-Christy Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
Quigley Furnace Specialties Co., Inc., New York, N. Y.
The Vitrefax Co., Los Angeles, Calif.
The Wahl Refractory Products Co., Fremont, O.

CEMENT KILNS
(See Kilns)

CEMENT MILL MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
J. R. Alsing Engineering Co., New York, N. Y.
American Process Co., New York, N. Y.—302
The Bonnot Co., Canton, O.—248
Bradley Pulverizer Co., Allentown, Pa.—286
L. R. Christie Co., Pittsburgh, Pa.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Duff Patents Co., Inc., Ptitsburgh, Pa.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Rubert M. Gay Co., Inc., New York, N. Y.—303
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardinge Co., New York, N. Y.—66-67
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Komnick Machy. Co., Detroit, Mich.—278, 301
Manitowoc Eng. Works, Manitowoc, Wis.—293
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
H. Miscampbell, Duluth, Minn.—246-247
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—38-39
The Reeves Bros. Co., Alliance, O.
Richardson Scale Co., Passaic, N. J.
Ruggles-Coles Engineering Co., New York, N. Y.
F. L. Smidth & Co., New York, N. Y.—69-70-71
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—89

CEMENT MILL CONTRACTORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Austin Co., Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
Buckbee, J. C., & Co., Chicago, Ill.—304
Burrell Eng. & Const. Co., Chicago, Ill.—295
Cowham Eng. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Macdonald Engineering Co. Chicago, Ill.—298
Manitowoc Eng. Works, Manitowoc, Wis.—293
Meade, R. K., & Co., Baltimore, Md.
Reeves Bros. Co., Alliance, O.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Ralph A. Watson Co., Anaconda, Mont.

CEMENT MILL REPAIRS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Ann Arbor Foundry Co., Ann Arbor, Mich.
The Bonnot Co., Canton, O.—248
Bradley Pulverizer Co., Allentown, Pa.—286
Chrome Steel Works, Carteret, N. J.—74
Columbus Conveyor Co., Columbus, O.—255
Cowham Eng. Co., Chicago, Ill.

CEMENT MILL REPAIRS—Cont'd

Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Empire Steel Casting Co., Reading, Pa.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardinge Co., New York, N. Y.—66-67
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302
Hubbard Steel Foundry Co., East Chicago, Ind.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Lobdell Car Wheel Co., Wilmington, Del.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Manitowoc Eng. Works, Manitowoc, Wis.—293
Moore & Moore, Inc., Reading, Pa.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Reeves Bros. Co., Alliance, O.
Stroh Steel Hardening Process Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—89
The Webster Mfg. Co., Chicago, Ill.

CEMENT PACKERS

Bates Valve Bag Co., Chicago, Ill.
S. Howes Co., Inc., Silver Creek, N. Y.
Modern Valve Bag Co., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.—298

CEMENT PUMPS
(See Pumps)

CEMENT ROOFING MACHINERY
(See Roofing Tile Machines)

CEMENT SCALES
(See Scales)

CEMENT SLURRY FILTERS
(See Filters, Cement Slurry)

CEMENT TESTING APPARATUS

Central Scientific Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
Riehle Bros. Testing Mach. Co., Philadelphia, Pa.
E. H. Sargent & Co., Chicago, Ill.
W. S. Tyler Co., Cleveland, O.
Will Corp., Rochester, N. Y.

CEMENTS (Insulating)

Celite Products Co., Los Angeles, Calif.—279

CHAIN

Allis - Chalmers Mfg. Co., Milwaukee, Wis.—power transmission—225
American Chain Co., Inc., Bridgeport, Conn.
American Manganese Steel Co., Chicago Hts., Ill.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
Beach Mfg. Co., Charlotte, Mich.
Bethlehem Fdry. & Mach. Co., Bethlehem, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.—280
Bucyrus Co., South Milwaukee, Wis.—steam shovel—Insert bet. 232-233
H. W. Caldwell & Son Co., Chicago, Ill.—303
The Carroll Chain Co., Columbus, O.—welded steam shovel, dredge, crane and sling—285
Chain Belt Co., Milwaukee, Wis.—96
The Cleveland Chain & Mfg. Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Columbus-McKinnon Chain Co., Columbus, O.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka ,Ind.—conveying
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Hadfield-Penfield Steel Co., Bucyrus, O.—manganese—271 and 300
The George Haiss Mfg. Co., Inc., New York, N. Y.
Howe Chain Co., Muskegon, Mich.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—malleable and steel
Manganese Steel Forge Co., Philadelphia, Pa.—manganese—76-77
The Medart Co., St. Louis, Mo.
Moore & Moore, Inc., Reading, Pa.
Morse Chain Co., Ithaca, N. Y.—power transmission—62
National Malleage & Steel Cast'g Co., Cleveland, O.
Newhall Chain Forge & Iron Co., New York, N. Y.—welded steam shovel
New Holland Machine Co., New Holland, Pa.—283
Palmer-Bee Co., Detroit, Mich.—6
Pettibone-Mulliken Co., Chicago, Ill.
Philadelphia Gear Works, Philadelphia, Pa.—265
D. Round & Son, Cleveland, O.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—conveyor and drive—95

CHAIN—Cont'd

Sturtevant Mill Co., Boston, Mass.—85
S. G. Taylor Chain Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—elevating and conveying.
Thaleg & Hock, Chicago, Ill.—33
Union Chain & Mfg. Co., Sandusky, O.—all kinds
The Union Engineering Co., Cleveland, O.
United States Chain & Forging Co., Pittsburgh, Pa.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
The Whitney Mfg. Co., Hartford, Conn.
Woodhouse Chain Works, Trenton, N. J.—

CHAIN DRIVES

Chain Belt Co., Milwaukee, Wis.—96
Dodge Mfg. Corp., Mishawaka, Ind.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Morse Chain Co., Ithaca, N. Y.—62
The Webster Mfg. Co., Chicago, Ill.

CHAIN HOISTS
(See Hoists, Chain)

CHAIN LINKS
(Cold Shuts, Repair, etc.)

Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
S. G. Taylor Chain Co., Chicago, Ill.
United States Chain & Forging Co., Pittsburgh, Pa.
Woodhouse Chain Works, Trenton, N. J.—267

CHANNELERS

Bedford Fdy &. Mach. Co., Bedford, Ind.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Sullivan Machinery Co., Chicago, Ill.—87

CHEMICALS

Central Scientific Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
Eimer & Amend Co., New York, N. Y.
E. H. Sargent & Co., Chicago, Ill.

CHEMISTS

Arnold & Weigel, Woodville, O.—250-251
Geo. Borrowman, Ph. D., Chicago, Ill.
Dearborn Chemical Co., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.
Eimer & Amend, New York, N. Y.
Robt. W. Hunt Co., Chicago, Ill.—305
Arthur D. Little, Inc., Cambridge, Mass.
H. E. Weidemann, St. Louis, Mo.
Warner Laboratories, Cresson, Pa.—294

CHIMNEYS

Heine Boiler Co., St. Louis, Mo.
H. R. Heinicke, Inc., Indianapolis, Ind.
Littleford Bros., Cincinnat,i O.
Manitowoc Engineering Works, Manitowoc, Wis.—steel—293
The Reeves Bros. Co., Alliance, O.
Weber Chimney Co., Chicago, Ill.
Wiederholdt Construction Co., New York, N. Y.

CHUTE LINERS

Advance Foundry Co., Dayton, O.—238
American Manganese Steel Co., Chicago Hts., Ill.
Chrome Steel Works, Carteret, N. J.—74
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manganese Steel Forge Co., Philadelphia, Pa.—plates—76-77
Peru Foundry Co., Peru, Ind.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

CHUTES

Advance Fdry. Co., Dayton, O.—"Strenes" metal—238
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Biehl Iron Works, Inc., Reading, Pa.
H. W. Caldwell & Son Co., Chicago, Ill.—303
C. S. Card Iron Works, Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Chrome Steel Works, Carteret, N. J.—74
Cross Eng. Co., Carbondale, Pa.—273
Easton Car & Construction Co., Easton, Pa.—10
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Fuller-Lehigh Co., Fullerton, Pa.—78-79
The Galion Iron Works & Mfg. Co., Galion, O.
The Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
Gehret Bros., Bridgeport, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Heine Boiler Co., St. Louis, Mo.
Hendrick Mfg. Co., Carbondale, Pa.—306
C. W. Hunt & Co., W. New Brighton, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Johns-Manville, Inc., New York, N. Y.
Kensington Steel Co., Chicago, Ill.—plates
The Kirk & Blum Mfg. Co., Cincinnati, O.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.

CHUTES—Cont'd

Littleford Bros., Cincinnati, O.
Logan Co., Louisville, Ky.—car
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
The Morrow Mfg. Co., Columbus, O.
Northern Conveyor & Mfg. Co., Janesville, Wis.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Foundry & Mfg. Co., Reading, Pa.
Peru Foundry Co., Peru, Ind.
The Robins Conveying Belt Co., New York, N. Y.—249
F. L. Smidth & Co., New York, N. Y.—69-70-71
Steacy-Schmidt Mfg. Co., York, Pa.
Sturtevant Mill Co., Boston, Mass.—85
The Sykes Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Union Chain & Mfg. Co., Sandusky, O.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

CLAMPS

The Aldon Co., Chicago, Ill.
American Manganese Steel Co., Chicago Hts., Ill.
Barrett Machine Co., Pittsburgh, Pa.—rail
The Cleveland Rock Drill Co., Cleveland, O.
Dixon Valve & Coupling Co., Philadephia, O.
Dodge Manufacturing Corp., Mishawaka, Ind.
The Hanson Clutch & Machy. Co., Tiffin, O.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Knox Mfg. Co., Philadelphia, Pa.
Mulconroy Co., Inc., Philadelphia, Pa.—hose

CLAMSHELL BUCKETS
See Buckets (Grab, Clamshell, etc.)

CLARIFIERS

The Dorr Co., New York, N. Y.—56
Hardinge Co., Inc., New York, N. Y.—66-67

CLASSIFIERS

The Allen Cone Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
H. W. Caldwell & Son Co., Chicago, Ill.—303
Colorado Iron Works Co., Denver, Colo.
Deister Concentrator Co., Fort Wayne, Ind.—299
The Dorr Co., New York, N. Y.—56
Hardinge Co., New York, N. Y.—6
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Northern Blower Co., Cleveland, O.—dust
The Patterson Foundry & Machine Co., East Liverpool, O.
Perfect Classifier Co., Nashville, Tenn.—285
Stephens-Adamson Mfg. Co., Aurora, Ill.—sand—95
W. S. Tyler Co., Cleveland, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
New Holland Machine Co., New Holland, Pa.—283
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273

CLAY-WORKING MACHINERY

The Bonnot Co., Canton, O.—248
Mackintosh-Hemphill Co:, Pittsburgh, Pa.—290
Manitowoc Eng. Works, Manitowoc, Wis.—293

CLIPS (Wire Rope)
(See Wire Rope Accessories)

CLUTCH BLOCKS (Asbestos)

Thomas L. Gatke, Chicago, Ill.—45

CLUTCH LININGS AND FACINGS (Asbestos)

Thomas L. Gatke, Chicago, Ill.—45

CLUTCHES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The Baldwin Chain & Mfg. Co., Worcester, Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—303
W. E. Caldwell Co., Louisville, Ky.—friction
Chain Belt Co., Milwaukee, Wis.—96
Columbus Conveyor Co., Columbus, O.—255
Cutler - Hammer Mfg. Co., Milwaukee, Wis.—magnetic—49
Dodge Mfg. Corp., Mishawaka, Ind.—friction
The Hanson Clutch & Machinery Co., Tiffin, O.—friction
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—friction—302
W. A. Jones Fdy. & Machine Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—friction—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—friction and jaw.
Magnetic Manufacturing Co., Milwaukee, Wis.—magnetic—291

CLUTCHES—Cont'd

The Medart Co., St. Louis, Mo.—friction
O. K. Clutch & Mfg. Co., Columbia, Pa.—friction
Palmer-Bee Co., Detroit, Mich.—6
A. Plamondon Mfg. Co., Chicago, Ill.
Twin Disc Clutch Co., Racine, Wis.—Insert bet. 2-3
Union Chain & Mfg. Co., Sandusky, O.
The Webster Mfg. Co., Chicago, Ill.—friction
Weller Mfg. Co., Chicago, Ill.—237
Western Eng. & Mfg. Co., Chicago, Ill.
T. B. Wood's Sons Co., Chambersburg, Pa.—233

COAL

Bell & Zoller Coal Co., Chicago, Ill.
Bertha-Consumers Co., Pittsburgh, Pa.
Logan County Coal Corp., Cincinnati, O.
Mahler Collieries Co., Cleveland, O.
Peerless Coal Co., Philadelphia, Pa.
Pennsylvania Coal & Coke Corp., New York, N. Y.

COAL PULVERIZING EQUIPMENT

Aero Pulverizer Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
American Process Co., New York, N. Y.—302
American Pulverizer Co., St. Louis, Mo.
Bethlehem Steel Co., Bethlehem, Pa.
Bonnot Co., Canton, O.—248
Bradley Pulverizer Co., Allentown, Pa.—286
L. R. Christie Co., Pittsburgh, Pa.
Combustion Engineering Corp., New York, N. Y.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Erie City Iron Works, Erie, Pa.
Excelsior Tool & Mach. Co., E. St. Louis, Mo.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Rubert M. Gay Co., New York, N. Y.—303
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardinge Co., New York, N. Y.—66-67
C. W. Hunt Company, West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.—58-59
K.-B. Pulverizer Co., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.—parts
Komnick Machy. Co., Detroit, Mich.—278, 301
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—254
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Northern Blower Co., Cleveland, O.
Orton Crane & Shovel Co., Chicago, Ill.—81
Palmer-Bee Co., Detroit, Mich.—6
The Patterson Foundry & Machine Co., East Liverpool, O.
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Power Specialty Co., New York, N. Y.
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—38-39
Richardson Scale Co., Passaic, N. J.
Riley-Stoker Corporation, Worcester, Miss.
Ross Power Equipment Co., Indianapolis, Ind.—new and used.
Ruggles-Coles (Division of Hardinge Co.), New York, N. Y.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Webster Mfg. Co., Chicago, Ill.
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

COCKS (Lubricated, Acid-proof)

Merco Norstrom Valve Co., San Francisco, Calif.—21

COLORS (For Cement and Mortar)

C. K. Williams & Co., Easton, Pa.

COMPRESSED AIR LINE FITTINGS

Dixon Valve & Coupling Co., Philadelphia, Pa.
Knox Mfg. Co., Philadelphia, Pa.

COMPRESSORS
(See Air Compressors)

CONCENTRATORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Bethlehem Shipbuilding Corp., Ltd., San Francisco, Calif.
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Colorado Iron Works Co., Denver, Colo.
Deister Concentrator Co., Ft. Wayne, Ind.—299
Dings Magnetic Separator Co., Milwaukee, Wis.—Inside front cover
The Dorr Co., New York, N. Y.—56
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300

CONCENTRATORS—Cont'd

Hardinge Co., New York, N. Y.—66-67
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Magnetic Mfg. Co., Milwaukee, Wis.—291
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Roberts & Schaefer Co., Chicago, Ill.—air—25
Ruggles-Coles Eng. Co., New York, N. Y.
Southwestern Engineering Co., Los Angeles, Calif.
Stearns-Rogers Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273
United Iron Works, Inc., Joplin, Mo.
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.

CONCRETE ADMIXTURES

Celite Products Co., Los Angeles, Calif.—279

CONCRETE BREAKERS (Pneumatic)

Sullivan Machinery Co., Chicago, Ill.—87

CONCRETE BRICK MACHINES
(See Brick Machines)

CONCRETE MIXERS
(See Mixers)

CONCRETE MOLDS (All Kinds)

Anchor Concrete Mchy. Co., Adrian, Mich.—277
Automatic Sealing Vault Co., Peru, Ind.—burial vault
Besser Sales Co., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.—60
Blystone Mfg. Co., Cambridge Springs, Pa.
Concrete Equipment Co., Holland, Mich.
Doswell & Kover, Ft. Wayne, Ind.—burial vault
W. E. Dunn Mfg. Co., Holland, Mich.
L. Hansen Co., Kansas City, Mo.
Helm Brick Machine Co., Cadillac, Mich.
The Heltzel Steel Form & Iron Co., Warren, O.—65
Ideal Concrete Mchy. Co., Cincinnati, O.—239
National Stone-Tile Corp., San Francisco, Calif.
Dr. Bernhardi Sohn, Eilenburg, Germany
Supertile Machinery Corp., Tecumseh, Mich.—tile
Zagelmeyer Cast Stone Block Machy. Co., Bay City, Mich.—305

CONCRETE PRODUCTS MACHINERY

Anchor Concrete Mchy. Co., Adrian, Mich.—277
Besser Sales Co., Chicago, Ill.
Blystone Mfg. Co., Cambridge Springs, Pa.
Concrete Equipment Co., Holland, Mich.
Crawfordsville Machy. Co., Indianapolis, Ind.
W. E. Dunn Manufacturing Co., Holland, Mich.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Helm Brick Mach. Co., Cadillac, Mich.
The Her-Born Eng. & Mfg. Co., Sandusky, O.
A. J. Heskett Concrete Machy. Co., Williamsport, Pa.—68
Ideal Concrete Mchy. Co., Cincinnati, O.—239
Kent Machine Co., Kent, O.
Mackintosh - Hemphill Co., Pittsburgh, Pa.—wearing parts—290
Multiplex Concrete Machy. Co., Elmore, O.
National Stone-Tile Corp., San Francisco, Calif.
Thos. W. Noble Co., Chicago, Ill.
Shope Brick So., Portland, Ore.
Dr. Bernhardi Sohn, Eilenburg, Germany
Zagelmeyer Cast Stone Block Machinery Co., Bay City, Mich.—305

CONDENSERS (Steam)

Worthington Pump & Machy. Corp., New York, N. Y.

CONTACTORS (Belt)

T. B. Wood's Sons Co., Chambersburg, Pa.—233

CONTAINERS
(See Barrels; also Drums)

CONTRACTORS AND BUILDERS

Burrell Eng. & Constr. Co., Chicago, Ill.—295
H. K. Ferguson Co., Cleveland, O.—232
Macdonald Engineering Co., Chicago, Ill.—298
Truscon Steel Co., Youngstown, O.

CONTROLLERS (Automatic Temperature)

The Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Kieley & Mueller, New York, N. Y.
Leeds and Northrup Co., Philadelphia, Pa.
Powers Regulator Co., Chicago, Ill.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maulen Co., New York, N. Y.

CONTROLLERS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49

CONTROLLERS (Electric)—Cont'd

Duro Metal Products Co., Chicago, Ill.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
Industrial Controller Co., Milwaukee, Wis.
Monitor Controller Co., Baltimore, Md.
Morgan Eng. Co., Alliance, O.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

CONVEYOR BELTING
(See Belting)

CONVEYOR CHAIN
(See Chain, also Conveyors)

CONVEYOR ROLLS

Alvey-Ferguson Co., Cincinnati, O.
The Coe Manufacturing Co., Painesville, O.
Rodney Hunt Machine Co., Orange, Mass.—302

CONVEYORS

Acme Road Machinery Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The Alvey-Ferguson Machy. Co., Cincinnati, O.
American Manganese Steel Co., Chicago Hts., Ill.
Anchor Concrete Mchy. Co., Adrian, Mich.—277
Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—36
Austin-Western Road Machinery Co., Chicago, Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
Barber-Greene Co., Aurora, Ill.—portable and permanent belt
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
Bethlehem Fdry. & Machy. Co., Bethlehem, Pa.—screw
Besser Sales Co., Chicago, Ill.
Bland Engineering Co., Minneapolis, Minn.
B. and W. Oil-less Conveyor Co., Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland, O.—belt and chain—280
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Buffalo Forge Co., Buffalo, N. Y.
Buffalo Weaving & Belting Co., Buffalo, N. Y.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Columbus Conveyor Co., Columbus, O.—255
Continental Motors Corp., Detroit, Mich.
Conveyors Corp. of America, Chicago, Ill.—steam jet, monorail, cableway
Conveyor Sales Co., New York, N. Y.
W. H. Dance, Cambridge, Mass.
The Diamond Rubber Co., Akron, O.—rubber belt
Dodge Mfg. Corp., Mishawaka, Ind.
Dorr Co., New York, N. Y.—56
W. E. Dunn Mfg. Co., Holland, Mich.
The Dust Recovering & Conveying Co., Cleveland, O.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.
Elwell-Parker Elec. Co., Cleveland, O.
Exeter Machine Works, Inc., West Pittston, Pa.
Fabreeka Belting Co., Boston, Mass.
Fairmont Mining Mchy. Co., Fairmont, W. Va.
Fuller Co., Catasauqua, Pa.—240
The Galion Iron Works & Mfg. Co., Galion, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Gandy Belting Co., Baltimore, Md.
Gifford-Wood Co., Hudson, N. Y.
The Godfrey Conveyor Co., Elkhart, Ind.
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
Goodyear Tire & Rubber Co., Akron, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
The Greenville Mfg. Co., Greenville, O.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Geo. Haiss Mfg. Co., New York, N. Y.—portable, belt
The Hamilton Mfg. Co., Columbus, O.—portable
Hesse-Eisted Iron Works, Portland, Ore.
Hettrick Mfg. Co., Toledo, O.
Holly Pneumatic Systems, Inc., New York, N. Y.
S. Howes Co., Silver Creek, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Ideal Concrete Machy. Co., Cincinnati, O.—concrete products—239
Iowa Mfg. Co., Cedar Rapids, Ia.—41
Jackson & Church Co., Saginaw, Mich.—257
The Jeffrey Mfg. Co., Columbus, O.—58-59
W. A. Jones Fdy. & Mch. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Komnick Mchy. Co., Detroit, Mich.—278, 301
Lansing Motor & Pump Co., Inc., Lansing, Mich.
Robert L. Latimer & Co., Philadelphia, Pa.
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—screw, portable, helicoid and belt—Back cover and 42-43

CONVEYORS—Cont'd

Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Logan Co., Louisville, Ky.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
McKinney-Harrington Co., North Chicago, Ill.—steel bucket and portable
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
George W. Moore Co., Chicago, Ill.
The Morrow Mfg. Co., Columbus, O.
W. F. Mosser & Son, Allentown, Pa.—screw
National Conveying Equipment Corp., Chicago, Ill.—portable
New Holland Mch. Co., New Holland, Pa.—283
The Northern Blower Co., Cleveland, O.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51
Portable Machinery Co., Passaic, N. J.—portable
Roberts & Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Sandvik Steel, Inc., New York, N. Y.—steel belt
Schaffer Poidometer Co., Pittsburgh, Pa.—5
James B. Seaverns Co., Chicago, Ill.—pan
F. L. Smidth & Co., Inc., New York, N. Y.—shaker, skipulter—69-70-71
Smith Eng. Works, Milwaukee, Wis.—283
Specialty Engineering Co., Philadelphia, Pa.—belt
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.
Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
The Sunbury Mfg. Co., Sunbury, O.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Union Chain & Mfg. Co., Sandusky, O.
The Union Engineereing Co., Cleveland, O.
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276
Universal Road Mchy. Co., Kingston, N. Y.—300
Ralph A. Watson Co., Anaconda, Mont.
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237
Wickwire Spencer Steel Co., Inc., New York, N. Y.
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5
T. B. Wood's Sons Co., Chambersburg, Pa.—233

CONVEYORS (Monorail and Cableway)

Brown Hoisting Mchy. Co., Cleveland, O.—280
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Galion Iron Works & Mfg. Co., Galion, O.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constr. Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
Wilbur G. Hudson Corp., New York, N. Y.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Palmer-Bee Co., Detroit, Mich.—6
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
James B. Seaverns Co., Chicago, Ill.

CONVEYING SYSTEMS (Pneumatic)

Allen Eng. & Mfg. Co., Savannah, Ga.
Conveyor Sales Co., New York, N. Y.
Dust Recovering & Conveying Co., Cleveland, O.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Guarantee Construction Co., New York, N. Y.
Holley Pneumatic Systems, Inc., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
The Kirk & Blum Mfg. Co., Cincinnati, O.
The Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51

COOLERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Process Co., New York, N. Y.—302
Bonnot Co., Canton, O.—248
Carrier Air Conditioning Co., Buffalo, N. Y.
L. R. Christie Co., Pittsburgh, Pa.
Duff Patents Co., Inc., Pittsburgh, Pa.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Hardinge Co., Inc., New York, N. Y.—66-67
Kennedy-Van Saun Eng. & Mfg. Corp., New York, N. Y.
Louisville Drying Machy. Co., Louisville, Ky.—305
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—254
H. Miscampbell, Duluth, Minn.—lime—246-247
W. F. Mosser & Son, Allentown, Pa.

COOLERS—Cont'd

The Northern Blower Co., Cleveland, O.—air
Pennsylvania Pump & Compressor Co., Easton, Pa.
The Reeves Bros. Co., Alliance, O.
Ross Power Equipment Co., Indianapolis, Ind.
Ruggles-Coles (Division of Hardinge Co.), New York, N. Y.—rotary
F. L. Smidth & Co., New York, N. Y.—69-70-71
Southwestern Engineering Co., Los Angeles, Calif.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.—rotary—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—89

CORDEAU-BICKFORD FUSE

Atlas Powder Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.—48
Hercules Powder Co., Wilmington, Del.—37

CORRECTING BASINS

F. L. Smidth & Co., New York, N. Y.—69-70-71

COUPLINGS

Ajax Flexible Coupling Co., Westfield, N. Y.
Albaugh-Dover Mfg. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—flexible and shaft—96
Chicago Pneumatic Tool Co., New York, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
DeLaval Steam Turbine Co., Trenton, N. J.—63
R. & J. Dick Co., Inc., Passaic, N. J.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Dixon Valve and Coupling Co., Philadelphia, Pa.
S. R. Dresser Mfg. Co., Bradford, Pa.—steel pipe
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
The Electric Controller & Mfg. Co., Cleveland, O.—flexible
Fairbanks-Morse Co., Chicago, Ill.—union—Insert bet. 72-73
Falk Corp., Milwaukee, Wis.—flexible and shaft—Insert bet. 232-233
Farrell Foundry & Machine Co., Buffalo, N. Y.
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.
The Wm. Ganschow Co., Chicago, Ill.—287
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
The B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
The Hanson Clutch & Machy. Co., Tiffin, O.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
D. O. James Mfg. Co., Chicago, Ill.—14-15
W. A. Jones Fdy. & Mch. Co., Chicago, Ill.
The Knox Manufacturing Co., Philadelphia, Pa.
Lecourtenay Co., Newark, N. J.—flexible
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
W. C. Lipe, Inc., Syracuse, N. Y.—flexible, shaft
The Lunkenheimer Co., Cincinnati, O.—swivel—299
Manitowoc Eng. Works, Manitowoc, Wis.—293
The Medart Co., St. Louis, Mo.—flexible
Mulconroy Co., Inc., Philadelphia, Pa.—hose
National Malleable & Steel Castings Co., Cleveland, O.—car
R. D. Nuttall Co., Pittsburgh, Pa.
O. K. Clutch & Machinery Co., Columbus, Pa.
Palmer-Bee Co., Detroit, Mich.—6
Philadelphia Gear Works, Philadelphia, Pa.—flexible and shaft—265
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Eng. & Machine Co., Baltimore, Md.
Sanford-Day Iron Works, Inc.—Knoxville, Tenn.
Smith and Serrell, Newark, N. J.—flexible
Sprout, Waldron & Co., Muncy, Pa.—298
Terry Steam Turbine Co., Hartford, Conn.
Union Chain & Mfg. Co., Sandusky, O.
United States Rubber Co., New York, N. Y.—hose, pipe, etc.—231
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wood Drill Works, Paterson, N. J.—hose
T. B. Wood's Sons Co., Chambersburg, Pa.—233

CRANES

American Hoist & Derrick Co., St. Paul, Minn.—caterpillar, locomotive—298
The Atlas Car & Mfg. Co., Cleveland, O.—storage battery, locomotive—260
Austin Machinery Corp., Toledo, O.
The R. & L. Baker Co., Cleveland, O.—electric
Bay City Dredge Works, Bay City, Mich.
Bay City Foundry & Machine Co., Bay City, Mich.—motor truck
Bedford Foundry & Machine Co., Bedford, Ind.
Birmingham Rail & Loco. Co., Birmingham, Ala.

CRANES—Cont'd

The Brown Hoisting Machinery Co., Cleveland, O.—280
The Browning Crane Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Byers Mach. Co., Ravenna, O.—truckrane—18
The Champion Engineering Co., Kenton, O.—overhead traveling
H. D. Conkey & Co., Mendota, Ill.—jib, hand power, electric traveling
Continental Motors Corp., Detroit, Mich.
Curtis Pneumatic Mach. Co., St. Louis, Mo.
The Dayton Whirley Co., Dayton, O.
Detroit Hoist and Machine Co., Detroit, Mich.—traveling
Dobbie Fdy. & Mch. Co., Niagara Falls, N. Y.
Drake Electric Hoist Co., Inc., Friendship, N. Y.
Elwell-Parker Elec. Co., Cleveland, O.
Erie Steam Shovel Co., Erie, Pa.—47
Forsythe Bros., New York, N. Y.—steam, locomotive and gasoline
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
The General Excavator Co., Marion, O.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Hill Clutch Machine & Foundry Co., Cleveland, O.—hand and electric—302
C. W. Hunt Co., W. New Brighton, N. Y.
Industrial Works, Bay City, Mich.
Koehring Company, Milwaukee, Wis.—crawler—gasoline or electric—30-31
Komnick Machy. Co., Detroit, Mich.—278, 301
Link-Belt Co., Chicago, Ill.—locomotive and crawler—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—crawler and locomotive
Manning, Maxwell & Moore, Inc., New York, N. Y.—traveling
The Marion Steam Shovel Co., Marion, O.—full circle (steam and electric)—26-27
Maris Brothers, Inc., Philadelphia, Pa.—electric,
McMyler-Interstate Co., Cleveland, O.—40
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Milwaukee Elec. Crane & Mfg. Co., Milwaukee, Wis.
Moore Speedcrane Co., Chicago, Ill.—44
Morgan Eng. Co., Alliance, O.
Northern Eng. Works, Detroit, Mich.—298
Northwest Eng. Co., Chicago, Ill.—Insert bet. 2-3
Ohio Locomotive Crane Co., Bucyrus, O.—282
The Ohio Power Shovel Co., Lima, O.
Orton Crane & Shovel Co., Chicago, Ill.—81
The Osgood Co., Marion, O.—301
Palmer-Bee Co., Detroit, Mich.—6
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
N. B. Payne & Co., New York, N. Y.
Penn Bridge Co., Beaver Falls, Pa.
Roeper Crane & Hoist Works, Inc., Reading, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
James B. Seaverns Co., Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Speeder Machinery Corp., Fairfield, Ia.
Squier-Rix Co., Milwaukee, Wis.
The Star Drilling Machine Co., Akron, O.—253
Thaleg & Hock, Chicago, Ill.—33
The Thew Shovel Co., Lorain, O.—Insert bet. 80-81
Toledo Crane Co., Bucyrus, O.—overhead electric traveling
The Universal Crane Co., Cleveland, O.
The Vergan-Schmidt Co., Chicago, Ill.
The Wellman-Seaver-Morgan Co., Cleveland, O.
Whiting Corporation, Harvey, Ill.
Wright Mfg. Co., Lisbon, O.—296
Yale & Towne Mfg. Co., Stamford, Conn.

CRUSHERS (Cinder)

The C. O. Bartlett & Snow Co., Cleveland, O.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardinge Co., New York, N. Y.—66-67
The Jeffrey Mfg. Co., Columbus, O.—58-59
Komnick Machy. Co., Detroit, Mich.—278 and 301
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
New Holland Mch. Co., New Holland, Pa.—283
Orton Crane & Shovel Co., Chicago, Ill.—81
The Patterson Foundry & Machine Co., East Liverpool, O.
Dr. Bernhardi Sohn, Eilenburg, Germany
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Webster Mfg. Co., Chicago, Ill.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

CRUSHERS (Disc)

New Holland Mch. Co., New Holland, Pa.—283
Symons Brothers Co., Milwaukee, Wis.—22-23

CRUSHERS (Hammer)

American Pulv. Co., St. Louis, Mo.
C. O. Bartlett & Snow Co., Cleveland, O.
Bossert Corp., Utica, N. Y.
Day Pulverizer Co., Knoxville, Tenn.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Gruendler Patent Crusher & Pulv. Co., St. Louis, Mo.—245
Hadfield-Penfield Co., Bucyrus, O.—271 and 300
Jeffrey Mfg. Co., Columbus, O.—58-59
K-B Pulverizer Corp., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manitowoc Eng. Works, Manitowoc, Wis.—293
New Holland Mch. Co., New Holland, Pa.—283
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

CRUSHERS (Jaw and Gyratory)

Acme Road Machy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Austin Mfg. Co., Chicago, Ill.—36
Austin-Western Road Mchy. Co., Chicago, Ill.
Earle C. Bacon, Inc., New York, N. Y.—jaw—275
Birmingham Rail & Loco. Co., Birmingham, Ala.
Brainard Pulverizer Co., Chicago, Ill.—jaw
Brown Hoisting Mchy. Co., Cleveland, O.—280
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Butterworth & Lowe, Grand Rapids, Mich.—300
Carthage Fdry. & Mach. Works, Carthage, Mo.—282
Colorado Iron Works Co., Denver, Colo.
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Exeter Machine Works, Inc., West Pittston, Pa.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
The Galion Iron Works & Mfg. Co., Galion, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Rubert M. Gay Co., Inc., New York, N. Y.—303
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—jaw—245
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
W. P. Heineken, Engr., New York, N. Y.
Hubbard Steel Foundry Co., East Chicago, Ind.
Iowa Mfg. Co., Cedar Rapids, Ia.—jaw (rock and ore)—41
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kent Mill Co., Brooklyn, N. Y.—jaw—276
Komnick Machinery Co., Detroit, Mich.—278 and 301
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Mackintosh-Hemphill Co., Pittsburgh, Pa.—rotary, jaw and gyratory—290
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Mead-Morrison Mfg. Co., East Boston, Mass.—coal and coke—75
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Morgan Engineering Co., Alliance, O.
W. F. Mosser & Son, Allentown, Pa.—rotary
New Holland Mch. Co., New Holland, Pa.—283
Orton Crane & Shovel Co., Chicago, Ill.—81
Palmer-Bee Co., Detroit, Mich.—6
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Robinson Mfg. Co., Muncy, Pa.
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Smith Eng. Works, Milwaukee, Wis.—283
Dr. Bernhardi Sohn, Eilenburg, Germany
Southwestern Eng. Co., Los Angeles, Calif.
Stearns Conveyor Co., Cleveland, O.
The Stevenson Co., Wellsville, O.
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—jaw, rotary, sledge—85
Symons Brothers Co., Milwaukee, Wis.—22-23
Thaleg & Hock, Chicago, Ill.—33
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
The Union Engineering Co., Cleveland, O.
United Iron Works, Joplin, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276
Universal Road Mchy. Co., Kingston, N. Y.—300
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.—jaw
Western Wheeled Scraper Co., Aurora, Ill.—portable—Insert bet. 232-233
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5
O. B. Wise Pulverizer Co., Knoxville, Tenn.

CRUSHERS (Laboratory)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Earle C. Bacon, Inc., New York, N. Y.—275
Central Scientific Co., Chicago, Ill.

CRUSHERS (Laboratory)—Cont'd

The Denver Fire Clay Co., Denver, Colo.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
The Jeffrey Mfg. Co., Columbus, O.—58-59
Mine & Smelter Suply Co., Denver, Colo.—Inside back cover
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—85
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Universal Crusher Co., Cedar Rapids, Ia.—276
Webb City & Cartersville Fdry. & Mach. Co., Webb City, Mo.
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5

CRUSHERS (Rotary)

Butterworth & Lowe, Grand Rapids, Mich.—300
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Jackson & Church Co., Saginaw, Mich.—257
Sturtevant Mill Co., Boston, Mass.—85

CRUSHERS (Single Roll)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.—also double roll
Brown Hoisting Mchy. Co., Cleveland, O.—280
H. W. Caldwell & Sons Co., Chicago, Ill.—coal—303
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
C. W. Hunt Co., W. New Brighton, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
New Holland Mch. Co., New Holland, Pa.—283
The Patterson Foundry & Machine Co., East Liverpool, O.
Pennsylvania Crusher Co., Philadelphia, Pa.—primary, secondary—Insert bet. 272-273
Ross Power Equipment Co., Indianapolis, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Stevenson Co., Wellsville, O.
United Iron Works, Inc., Joplin, Mo.
Webb City & Cartersville Fdry. & Machine Co., Webb City, Mo.

CRUSHER PROTECTORS

(See Magnetic Pulleys)

CRUSHER REPAIR PARTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
Bethlehem Fdy. & Machine Co., Bethlehem, Pa.
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Chrome Steel Works, Carteret, N. J.—74
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Empire Steel Casting Co., Reading, Pa.
Excelsior Tool & Mach Co., E. St. Louis, Ill.
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Frog Switch & Mfg. Co., Carlisle, Pa.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Good Roads Machy. Co., Inc., Kennett Square, Pa.—61
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hubbard Steel Fdy. Co., East Chicago, Ind.
Iowa Mfg. Co., Cedar Rapids, Ia.—41
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Lobdell Car Wheel Co., Wilmington, Del.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Moore & Moore, Inc., Reading, Pa.
Midvale Co., Philadelphia, Pa.—54
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Pettibone-Mulliken Co., Chicago, Ill.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276
Webster Mfg. Co., Chicago, Ill.
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5

CRUSHING AND SCREENING PLANTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—portable—225
Austin-Western Road Machinery Co., Chicago, Ill.
Earl C. Bacon, Inc., New York, N. Y.—275
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
W. H. K. Bennett, Chicago, Ill.
Burrell Eng. & Const. Co., Chicago, Ill.—295
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
The Galion Iron Works & Mfg. Co., Galion, O.
The Good Roads Machy. Co., Kennett Square, Pa.—61
Wilbur G. Hudson Corp., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.—portable—41
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Macdonald Engineering Co., Chicago, Ill.—298
Mead-Morrison Mfg. Co., E. Boston, Mass.—coal and coke—75
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Northern Conveyor & Mfg. Co., Janesville, Pa.
Roberts and Schaefer Co., Chicago, Ill.—25
Ross Power Equipment Co., Indianapolis, Ind.
Schaffer Engineering Co., Pittsburgh, Pa.
Sturtevant Mill Co., Boston, Mass.—85
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
The Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5

CRUSHING PLANTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
C. O. Bartlett and Snow Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Colorado Iron Works Co., Denver, Colo.
Eagle Iron Works, Des Moines, Ia.—305
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Fulton Iron Works Co., St. Louis, Mo.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Hadfield-Penfield Steel Co., Bucyrus, O.—manganese steel—271 and 300
Joshua Hendy Iron Works, San Francisco, Calif.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.
Kent Mill Co., Brooklyn, N. Y.—276
Komnick Machy. Co., Detroit, Mich.—278 and 301
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Lobdell Car Wheel Co., Wilmington, Del.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Midvale Co., Nicetown, Philadelphia, Pa.—54
New Holland Mch. Co., New Holland, Pa.—283
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Pettibone-Mulliken Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—249
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
Stearns-Roger Mfg. Co., Denver, Colo.
Stevenson Co., Wellsville, O.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Webb City and Carterville Foundry & Machine Works, Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

CUTTERS

J. R. Alsing Eng. Co., Inc., New York, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
S. Howes Co., Silver Creek, N. Y.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
M. D. Knowlton Co., Rochester, N. Y.—plaster board—268
Smith Eng. Wks., Milwaukee, Wis.—283

CUTTING APPARATUS

(See Welding and Cutting)

DECARBONIZING APPARATUS

The Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., New York, N. Y.—4

DERRICKS

American Hoist & Derrick Co., St. Paul, Minn.—wood and steel—298
Beckwith Machinery Co., Pittsburgh, Pa.—all types
Bedford Foundry & Machine Co., Bedford, Ind.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Byers Machine Co., Ravenna, O.—portable—18
Clyde Iron Works, Duluth, Minn.—timber and steel
The Dayton Whirley Co., Dayton, O.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.—steel and wood
S. Flory Mfg. Co., Bangor, Pa.—304
Forsythe Bros., New York, N. Y.—steel and wood
Harnischfeger Corporation, Milwaukee, Wis.—Insert bet. 8-9
John T. Horton, Inc., New York, N. Y.
Hayward Co., New York, N. Y.—11
Insley Mfg. Co., Indianapolis, Ind.
Joshua Hendy Iron Works, San Francisco, Calif.
Lidgerwood Mfg. Co., New York, N. Y.—steel and wood—64
The McMyler-Interstate Co., Cleveland, O.—40
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
The Mundy Sales Corp., New York, N. Y.—16
National Hoisting Engine Co., Harrison, N. J.
National Iron Co., Duluth, Minn.
Pawling and Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Penn Bridge Co., Beaver Falls, Pa.—all types
Street Bros. Mach. Works, Chattanooga, Tenn.
Superior Iron Works, Superior, Wis.
Thomas Elevator Co., Chicago, Ill.—J299
G. H. Williams Co., Erie, Pa.

DERRICK FITTINGS

American Hoist & Derrick Co. St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
Bedford Fdy. & Mach. Co., Bedfird, Ind.
Clyde Iron Works, Duluth, Minn.
Dobbie Foundry & Mch. Co., Niagara Falls, N. Y.
S. Flory Mfg. Co., Bangor, Pa.—304
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Hayward Co., New York, N. Y.—11
John T. Horton Co., Inc., New York, N. Y.
Lidgerwood Mfg. Co., New York, N. Y.—64
Manitowoc Eng. Works, Manitowoc, Wis.—293
H. J. Miller Lumber Co., Seattle, Wash.
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
The Mundy Sales Corp., New York, N. Y.—16
United Iron Works, Joplin, Mo.
G. H. Williams Co., Erie, Pa.

DEWATERING MACHINES
(See also Classifiers)

Allen Cone Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Process Co., New York, N. Y.—302
Colorado Iron Works Co., Denver, Colo.
The Dorr Co., New York, N. Y.—56
Galland-Henning Mfg. Co. Milwaukee, Wis.
Hardinge Co., New York, N. Y.—66-67
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Louisville Drying Mach. Co., Louisville, Ky.—305
Perfect Classifier Co., Nashville, Tenn.—285
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
H. R. Wahl & Co., Chicago, Ill.

DIESEL ENGINES
(See Engines)

DIPPERS (Steam Shovel)
(See Manganese Steel)

American Manganese Steel Co., Chicago Hts., Ill.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Erie Steam Shovel Co., Erie, Pa.—47
Farrell-Cheek Steel. Fdy. Co., Sandusky, O.—244
Frog, Switch & Mfg. Co., Carlisle, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Manitowoc Eng. Works, Manitowoc, Wis.—293
The McMyler-Interstate Co., Cleveland, O.—40
Marion Steam Shovel Co., Marion, O.—26-27
Orton Crane & Shovel Co., Chicago, Ill.—81
Pettibone Mulliken Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Thew Shovel Co., Lorain, O.—Insert bet. 80-81

DIPPER TEETH
(See also Manganese Steel)

American Manganese Steel Co., Chicago Hts., Ill.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Erie Steam Shovel Co., Erie, Pa.—47
Farrell-Cheek Steel. Fdy. Co., Sandusky, O.—244

DIPPER TEETH—Cont'd

Frog, Switch & Mfg. Co., Carlisle, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.—26-27
The McMyler-Interstate Co., Cleveland, O.—40
Orton Crane & Shovel Co., Chicago, Ill.—81
Pettibone Mulliken Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Thew Shovel Co., Lorain, O.—Insert bet. 80-81
Western Crucible Steel Casting Co., Minneapolis, Minn.—32

DITCHING MACHINES
(See Backfillers)

DOORS (Mine)

The American Mine Door Co., Canton, O.
Conveyors Corp. of America, Chicago, Ill.
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Ross Power Equipment Co., Indianapolis, Ind.

DRAG SCRAPERS

American Manganese Steel Co., Chicago Hts., Ill.
American Mfg. & Eng. Co., Kalamazoo Mich.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Cable Excavator Co., Fernwood, Pa.
The Galion Iron Works & Mfg. Co., Galion, O.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Construction Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Jeffrey Mfg. Co., Columbus, O.—58-59
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Mundy Sales Corp., New York, N. Y.—16
Ottumwa Iron Works, Ottumwa, Ia.
Sauerman Bros., Chicago, Ill.—256
Scofield-Burkett Construction Co., Macon, Ga.
Thomas Elevator Co., Chicago, Ill.—299
United Iron Works, Inc., Joplin Mo.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

DRAGLINES

American Manganese Steel Co., Chicago Hts., Ill.
Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Brown Hoisting Mchy. Co., Cleveland, O.—280
The Browning Crane Co., Cleveland O.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
The Byers Machine Co., Ravenna, O.—18
The Dayton Whirley Co., Dayton, O.
Erie Steam Shovel Co., Erie, Pa.—47
The Fundum Hoist & Shovel Co., Lima, O.
The General Excavator Co., Marion, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Harnischfeger Corporation, Milwaukee, Wis.—Insert bet. 8-9
The Hayward Co., New York, N. Y.—11
Industrial Works, Bay City, Mich.
Insley Mfg. Co. Indianapolis, Ind.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Koehring Company, Milwaukee, Wis.—30-31
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottried Co., San Francisco, Calif.
Marion Steam Shovel Co., Marion, O.—26-27
McMyler-Interstate Co., Cleveland, O.—40
Monighan Mch. Co., Chicago, Ill.—7
Moore Speedcrane Co., Chicago, Ill.—44
Northwest Engineering Co., Chicago, Ill.—Insert bet. 2 and 3
Ohio Locomotive Crane Co., Bucyrus, O.—282
The Ohio Power Shovel Co., Lima, O.
Orton Crane & Shovel Co., Chicago, Ill.—81
The Osgood Co., Marion, O.—301
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Speeder Machinery Corp., Fairfield, Ia.
Street Bros. Mach. Works, Chattanooga, Tenn.
Thaleg & Hock, Chicago, Ill.—33
Thew Shovel Co., Lorain, O.—Insert bet. 80-81
The Universal Crane Co., Cleveland, O.

DRAGLINE CABLEWAY EXCAVATORS

American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
American Mfg. & Eng. Co., Kalamazoo, Mich.
The Browning Crane Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Cableway Excavator Co., Fernwood, Pa.
Erie Steam Shovel Co., Erie, Pa.—47
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Hayward Co., New York, N. Y.—11

DRAGLINE CABLEWAY EXCAVATORS—Cont'd

Good Roads Mach. Co., Inc., Kennett Square, Pa.—61
Joshua Hendy Iron Works, San Francisco, Calif.
Indianapolis Cable Excavator Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Marion Steam Shovel Co., Marion, O.—26-27
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
The Mundy Sales Corp., New York, N. Y.—16
Novo Engine Co., Lansing, Mich.—236
Page Engineering Co., Chicago Ill.
Pioneer Bucket Co., Indianapolis, Ind.
Ross Power Equipment Co., Indianapolis, Ind.
Sauerman Bros., Chicago, Ill.—256
Scofield-Burkett Construction Co., Macon, Ga.
Thaleg & Hock, Chicago, Ill.—33
Thomas Elevator Co., Chicago, Ill.—299

DRAGLINE EXCAVATORS

Dayton-Whirley Co., Dayton, O.
Monighan Machine Co., Chicago, Ill.—7
Northwest Eng. Co., Chicago, Ill.—Insert bet. 2-3
Orton Crane & Shovel Co., Chicago, Ill.—81
The Osgood Company, Marion, O.—301
Thew Shovel Co., Lorain, O.—Insert bet. 80-81

DRAWING (Instruments and Materials)

Eugene Dietzgen & Co., Chicago, Ill.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch Co., New York, N. Y.
Pease Instrument Co. Chicago, Ill.

DREDGE CHAIN
(See Chain)

DREDGE PIPE
(See Pipe)

DREDGES

American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.—dipper and dragline
W. H. K. Bennett, M. E., Chicago, Ill.
Bucyrus Co., South Milwaukee, Wis.—dipper, hydraulic, elevator—Insert bet. 232-233
Ellicott Mach. Corp., Baltimore, Md.—hydraulic, chain, bucket
S. Flory Mfg. Co., Bangor, Pa.—304
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Hayward Co., New York, N. Y.—steam—11
Kensington Steel Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York, N. Y.—64
Mackintosh-Hemphill Co., Pittsburgh, Pa.—sand and gravel—290
Manitowoc Eng. Works, Manitowoc, Wis.—293
The Marion Steam Shovel Co., Marion, O.—26-27
McMyler-Interstate Co., Cleveland, O.—40
Morris Machine Works, Baldwinsville, N. Y.—hydraulic
The Mundy Sales Corp., New York, N. Y.—16
The Norbom Engineering Co., Darby, Pa.—hydraulic
Osgood Co., Marion, O.—dipper—301
Stearns-Roger Mfg. Co. Denver, Colo.
Thomas Elevator Co., Chicago, Ill.—299
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237

DREDGE PIPE SLEEVES

American Manganese Steel Co., Chicago Hts., Ill.
W. H. K. Bennett, M. E., Chicago, Ill.
Cincinnati Rubber Mfg. Co., Cincinnati, O.—235
The Diamond Rubber Co., Akron, O.
S. R. Dresser Mfg. Co., Bradford, Pa.
Erie Pump & Engine Wks., Medina, N. Y.—292
S. Flory Mfg. Co., Bangor, Pa.—304
The B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Knox Mfg. Co., Philadelphia, Pa.
New York Rubber Co., New York, N. Y.
Pettibone Mulliken Co., Chicago, Ill.
Reading Steel Casting Co., Inc., Bridgeport Conn.
United Iron Wks., Inc., Joplin, Mo.

DREDGE PUMPS
(See Pumps)

DRILL STEEL

The Bethlehem Steel Co., Bethlehem, Pa.
Central Alloy Steel Corp., Canton, O.
Chicago Pneumatic Tool Co. New York, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
Colonial Steel Co., Pittsburgh, Pa.—281
Denver Rock Drill Mfg. Co., Denver, Colo.—80
Hardsocg Promotion Co., Ottumwa, Ia.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Ludlum Steel Co., Watervliet, N. Y.—305
Midvale Co., Nicetown, Philadelphia, Pa.—54
Schramm, Inc., West Chester, Pa.
Sullivan Machinery Co., Chicago, Ill.—87

DRILL STEEL SHARPENING MACHINES

Armstrong Mfg. Co., Waterloo, Ia.—55
Denver Rock Drill Mfg. Co., Denver, Colo.—80
Gill Rock Drill Co., Lebanon, Pa.
Gilman Mfg. Co., E. Boston Mass.—automatic heat treating
Hardsocg Promotion Co., Ottumwa, Ia.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Sullivan Machinery Co., Chicago, Ill.—87

DRILLS (Blast Hole)

The American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Ia.—55
The Burch Plow Works, Crestline, O.
Burkhardt Co., Kiel, Wis.
Erie Pump & Engine Works, Medina, N. Y.—292
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Keystone Driller Co., Beaver Falls, Pa.—297
Loomis Machine Co., Tiffin, O.—20
Sanderson-Cyclone Drill Co., Orrville, O.—17
Star Drilling Machine Co., Akron, O.—253
United Iron Wks., Joplin, Mo.

DRILLS (Diamond Core)

(See Prospecting Machinery)

DRILLS (Tripod and Hammer)

The Aldon Co., Chicago, Ill.—rails, track, etc.
Buffalo Forge Co., Buffalo, N. Y.
Champaign Blower & Forge Co., Lancaster, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
The Cleveland Rock Drill Mfg. Co., Cleveland, O.
Cochise Rock Drill Mfg. Co., Los Angeles, Calif.
Denver Rock Drill Mfg. Co., Denver, Colo.—80
Diamond Machine Co., Monongahela, Pa.
Gilman Mfg. Co., East Boston, Mass.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Hardsocg Promotion Co., Ottumwa, Ia.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
The Jeffrey Mfg. Co., Columbus, O.—58-59
Manning, Maxwell & Moore, Inc., New York, N. Y.
Schramm, Inc., West Chester, Pa.
Sullivan Mach. Co., Chicago, Ill.—87
Wood Drill Works, Paterson, N. J.

DRILLING ACCESSORIES

The American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Ia.—55
Burkhardt Co., Kiel, Wis.
Chicago Pneumatic Tool Co. New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Denver Rock Drill Mfg. Co., Denver, Colo.—80
Gill Rock Drill Co., Lebanon, Pa.
Gilman Mfg. Co., E. Boston, Mass.
Hardsocg Promotion Co., Ottumwa, Ia.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
Howels Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Knox Mfg. Co., Philadelphia, Pa.
Loomis Machine Co., Tiffin, O.—20
Pawling & Harnischfeger Co., Milwaukee, Wis. —Insert bet. 8-9
Sanderson Cyclone Drill Co., Orrville, O.—17
Schramm, Inc., West Chester, Pa.
The Star Drilling Machine Co., Akron, O.—253
Sullivan Machinery Co., Chicago, Ill.—87
The Trolley Supply Co., Massillon, O.
United Iron Works, Inc., Joplin, Mo.
Wood Drill Works, Paterson N. J.

DRIVES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—close center—225
Bird Machine Co., South Walpole, Mass.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.—chain
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Cleveland Worm and Gear Co., Cleveland, O.—worm—82-83
Dodge Mfg. Co., Mishawaka, Ind.
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—belt, take-up, rope and gear—302
Howe Chain Co., Muskegon, Mich.
Jeffrey Mfg. Co., Columbus, O.—58-59
W. A. Jones Foundry and Machine Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.—chain—62
Palmer-Bee Co., Detroit, Mich.—6
Poole Engineering & Machine Co., Baltimore, Md.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Stephens-Adamson Mfg. Co., Aurora, Ill.—95

DRIVES—Cont'd

Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
Union Chain & Mfg. Co., Sandusky, O.
Watson-Flagg Eng. Co., Paterson, N. J.—278
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Western Valve Bag Co., Chicago, Ill.
Whitney Mfg. Co., Hartford, Conn.—silent chain
T. B. Wood's Sons Co., Chambersburg, Pa.—233

DRUMS (Magnetic)

Dings Magnetic Separator Co., Milwaukee, Wis.—Inside front cover
Magnetic Mfg. Co., Milwaukee, Wis.—291

DRUMS (Shipping)

(See Barrels)

DRYERS (Gypsum Board)

The Coe Mfg. Co., Painesville, O.
Drying Systems, Inc., Chicago, Ill.—292

DRYERS (Rotary)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Blower Co., Detroit, Mich.
American Process Co., New York, N. Y.—302
The C. O. Bartlett and Snow Co., Cleveland, O.
The Bonnot Co., Canton, O.—248
Buckeye Dryer Co., Chicago, Ill.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Chicago Bridge & Iron Works, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Pa.
Coatsville Boiler Works, Philadelphia, Pa.
Colorado Iron Works, Denver, Colo.
J. P. Devine Co., Buffalo, N. Y.
Duff Patents Co., Inc., Pittsburgh, Pa.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Galland-Henning Mfg. Co., Milwaukee, Wis.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hetherington & Berner, Indianapolis, Ind.—sand
Hyde & Co., Pittsburgh, Pa.—sand
Indiana Foundry Co., Inc., Indiana, Pa.—sand
The Jeffrey Mfg. Co., Columbus, O.—58-59
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Komnick Machy. Co., Detroit, Mich.—bricks, stationary—278-301
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Louisville Drying Machy. Co., Louisville, Ky.—305
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., Inc., York, Pa.—254
McLanahan Stone Machine Co., Hollidaysburg, Pa.—272
W. F. Mosser & Son, Allentown, Pa.
Murray Iron Works Co., Burlington, Ia.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Raymond Bros. Impact Pulv. Co., Chicago, Ill. —38-39
The Reeves Bros. Co., Alliance, O.
Ross Power Equipment Co., Indianapolis, Ind.
Ruggles-Coles (Division of Hardinge Co.), New York, N. Y.
T. S. Schofield's Sons Co., Macon, Ga.
Steacy-Schmidt Mfg. Co., York, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
The Union Engineering Co., Cleveland, O.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Weller Mfg. Co., Chicago, Ill.—237

DRYERS (Stationary)

H. Miscampbell, Duluth, Minn.—246-247
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Komnick Machy. Co., Detroit, Mich.—278 and 301

DRYERS (Tower)

Earle C. Bacon, Inc., New York, N. Y.—275
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
McGann Mfg. Co., York, Pa.—254
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

DRYING OVENS (Laboratory)

Central Scientific Co., Chicago, Ill.
The Kirk & Blum Mfg. Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
E. H. Sargent & Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.—258-259

DUMP BODIES

(See Motor Truck Bodies)

DUST ARRESTERS

(See Dust Collectors)

DUST BLOWERS

Electric Blower Co., Boston, Mass.

DUST COLLECTING SYSTEMS

Allen Engineereing Mfg. Co., Savannah, Ga.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Blower Co., Detroit, Mich.
American Fdy. Equip. Co., Mishawaka, Ind.
Barnard Mach. Co., Enterprise, Kans.
Bayley Mfg. Co., Milwaukee, Wis.
Bossert Corp., Utica, N. Y.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
By-Products Recoveries, New York, N. Y.
Clark Dust Collecting Co., Chicago, Ill.
Dust Recovering & Conveying Co., Cleveland, O.
Federal Pneumatic Systems, Inc., Chicago, Ill.
Rubert M. Gay Co., New York, N. Y.—303
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
The Kirk & Blum Mfg. Co., Cincinnati, O.
The MacLeod Co., Cincinnati, O.
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—254
H. Miscampbell, Duluth, Minn.—246-247
The Northern Blower Co., Cleveland, O.
Pangborn Corporation, Hagerstown, Md.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—38-39
The W. W. Sly Mfg. Co., Cleveland, O.—243
Standard Steel Works, North Kansas City, Mo.
E. H. Stroud and Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85

DUST CONVEYING SYSTEMS

Fuller Company, Catasauqua, Pa.—240
Dust Recovering & Conveying Co., Cleveland, O.
W. W. Sly Mfg. Co., Cleveland, O.—243
J. W. Paxson Co., Philadelphia, Pa.—50-51

DYNAMITE AND BLASTING POWDER

(See Explosives and Blasting Supplies)

ECONOMIZERS

(See Fuel Economizers)

ELECTRICAL HAULAGE SYSTEMS

General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.—258-259
Woodford Engineering Co., Chicago, Ill.—Insert bet. 232-233
Geo. D. Whitcomb Co., Rochelle, Ill.—305
Goodman Mfg. Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.

ELECTRIC LIGHTING PLANTS

The Cook Motor Co., Delaware, O.—280

ELECTRIC POWER EQUIPMENT

(Motors, Controllers, Transformers, Generators, etc.)

The Louis Allis Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Burke Electric Co., Erie, Pa.
Century Electric Co., St. Louis, Mo.
Cleveland Electric Motor Co., Cleveland, O.
Continental Motors Corp., Detroit, Mich.
The Cook Motor Co., Delaware, O.—generating sets—280
Crocker-Wheeler Co., New York, N. Y.
De Laval Steam Turbine Co., Trenton, N. J.—turbo-generators—63
The Electric Controller & Mfg. Co., Cleveland, O.
Electric Mchy. Mfg. Co., Minneapolis, Minn.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
Howell Electric Motors Co., Howell, Mich.
Ideal Electric Mfg. Co., Mansfield, O.
Kuhlman Electric Co., Bay City, Mich.
The Lincoln Electric Co., Cleveland, O.
Alexander Milburn Co., Baltimore, Md.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
H. Miscampbell, Duluth, Minn.—246-247
Pyle-National Co., Chicago, Ill.—turbo-generators
The Reliance Elec. & Eng. Co., Cleveland, O.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Roth Bros. & Co., Chicago, Ill.
Schramm, Inc., West Chester, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Sorgel Electric Co., Milwaukee, Wis.
The Triumph Elec. Corp., Cincinnati, O.
Universal Motor Co., Oshkosh, Wis.
Wagner Electric Corp., St. Louis, Mo.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.—258-259

ELECTRO-MAGNETIC SEPARATORS
(See Magnetic Devices)

ELEVATOR BELTING (See Belting)

ELEVATOR BUCKETS (See Buckets)

ELEVATORS AND CASINGS

Acme Road Machy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The Alvey-Ferguson Machy. Co., Cincinnati, O.
American Manganese Steel Co., Chicago Hts., Ill.
Anchor Concrete Machy. Co., Adrian, Mich.—277
Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—36
Austin-Western Road Machy. Co., Chicago, Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
Barber-Greene Co., Aurora, Ill.
The C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Bland Engineering Co., Minneapolis, Minn.
The Brown Hoisting Machy. Co., Cleveland, O.—280
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
H. W. Caldwell & Son, Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Columbus Conveyor Co., Columbus, O.—255
W. H. Dance, Cambridge, Mass.
Dodge Mfg. Corp., Mishawaka, Ind.
The Dust Recovering & Conveying Co., Cleveland, O.
W. E. Dunn Mfg. Co., Holland, Mich.
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Exeter Machine Works, Inc., West Pittston, Pa.
Fuller Co., Catasauqua, Pa.—240
Galion Iron Works & Mfg. Co., Galion, O.
Gandy Belting Co., Baltimore, Md.
Gifford-Wood Co., Hudson, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
George Haiss Mfg. Co., Inc., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.—306
Hesse-Ersted Iron Works, Portland, Ore.
Holly Pneumatic Systems, Inc., New York, N. Y.
Howe Chain Co., Muskegon, Mich.
Wilbur G. Hudson Corp., New York, N. Y.
Interstate Equip. Corp., New York, N. Y.—24
Iowa Mfg. Co., Cedar Rapids, Ia.—41
Jackson & Church Co., Saginaw, Mich.—257
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Komnick Machy. Co., Detroit, Mich.—278 and 301
Robert L. Latimer & Co., Philadelphia, Pa.
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macdonald Engineering Co., Chicago, Ill.—298
McKinney-Harrington Co., North Chicago, Ill.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
The Morrow Mfg. Co., Columbus, O.
National Conveying Equipment Corp., Chicago, Ill.
New Holland Mach. Co., New Holland, Pa.—283
Northern Conveyor & Mfg. Co., Janesville, Wis.
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51
Roberts & Schaefer Company, Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Smith Eng. Wks., Milwaukee, Wis.—283
The T. L. Smith Co., Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa. 262-263
Union Chain & Mfg. Co., Sandusky, O.
The Union Engineering Co., Cleveland, O.
United Iron Works, Inc., Joplin, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276

ELEVATORS AND CASINGS—Cont'd

Universal Road Mch. Co., Kingston, N. Y.—300
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webb City & Cartersville Foundry & Machine Works, Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

ENGINEERS

Acme Road Mchy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
J. R. Alsing, New York, N. Y.
The American Appraisal Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Hts., Ill.
American Process Co., New York, N. Y.—302
Arnold & Weigel, Woodville, O.—250-251
The Austin Co., Cleveland, O.
Austin Mfg. Co., Chicago, Ill.—36
Earle C. Bacon, Inc., New York, N. Y.—275
W. H. K. Bennett, M. E., Chicago, Ill.
Besser Sales Co., Chicago, Ill.—concrete products plants
Bland Eng. Co., Minneapolis, Minn.
Bollinger-Andrews Construction Co., Pittsburgh, Pa.—304
The Bonnot Company, Canton, O.—248
Brainard-Fairchild Engineering Co., Chicago, Ill.
Bradley Pulverizer Co., Allentown, Pa.—286
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
J. C. Buckbee Co., Chicago, Ill.—304
Burrell Eng. & Constr. Co., Chicago, Ill.—295
Butterworth & Lowe, Grand Rapids, Mich.—gypsum and gypsum plaster plants—300
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Chapman Engineering Co., Mt. Vernon, O.
Chicago Engineering Associates, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Pa.
F. W. Cooper, Nashville, Tenn.
Coe Mfg. Co., Painesville, O.—gypsum wall board drying plants
Cowham Engineering Co., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.—chemical
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
The Dorr Co., New York, N. Y.—56
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.
J. B. Ehrsam & Sons, Enterprise, Kan.—gypsum and gypsum plaster plants—301
Exeter Machine Works, Inc., West Pittston, Pa.
H. K. Ferguson Co., Cleveland, O.—232
The Foundation Co., New York, N. Y.
Fuller Company, Catasauqua, Pa.—240
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Galland-Henning Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Glamorgan Pipe & Foundry Co., Lynchburg, Va. lime plants
Goheen Corp. of N. J., Newark, N. J.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
Gypsum Eng. & Mfg. Co., Chicago, Ill.—228
Geo. Haiss Mfg. Co., New York, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hardinge Co., New York, N. Y.—66-67
James N. Hatch, Chicago, Ill.
Hetherington & Berner, Inc., Indianapolis, Ind.
Hill Clutch Machine & Fdy. Co., Cleveland, O.—power transmission—302
Holly Pneumatic Systems, Inc., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Robt. W. Hunt Co., Chicago, Ill.—305
The Improved Equipment Co., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.—41
Jackson & Church Co., Saginaw, Mich.—257
The Jeffrey Mfg. Co., Columbus, O.—58-59
K-B Pulverizer Corp., New York, N. Y.—combustion and crushing
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kritzer Co., Chicago, Ill.—303
The Lakewood Engineering Co., Cleveland, O.
Lancaster Iron Works, Inc., Lancaster, Pa.—lime plant
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Arthur D. Little, Inc., Cambridge, Mass.—ceramic, chemical
Macdonald Engineering Co., Chicago, Ill.—298
McGann Mfg. Co., York, Pa.—254
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Richard K. Meade & Co., Baltimore, Md.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
H. Miscampbell, Duluth, Minn.—246-247
Morgan Eng. Co., Alliance, O.
Morgan Construction Co., Worcester, Mass.
Munson Mill Machinery Co., Inc., Utica, N. Y.
Murray Iron Works, Burlington, Ia.—power plant
The Northern Blower Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51
Charles L. Pillsbury Co., Minneapolis, Minn.

ENGINEERS—Cont'd

Pittsburgh Testing Laboratory, Pittsburgh, Pa.—inspecting—chemical consulting
Poole Engineering & Machine Co., Baltimore, Md.
Randolph Perkins Co., Chicago, Ill.
Roberts and Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ruggles-Coles Engineering Co., New York, N. Y.
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Schaffer Engineering Co., Pittsburgh, Pa.
James B. Seaverns Co., Chicago, Ill.
F. L. Smidth & Co., New York, N. Y.—cement plants—69-70-71
Southwestern Engineering Co., Los Angeles, Calif.
The Spencer Construction Co., Baltimore, Md. (Eastern branch: Macdonald Eng. Co.)
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston , Mass.—85
W. Toepfer & Sons Co., Milwaukee, Wis.—sand-lime brick—288
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
The Union Engineering Co., Cleveland, O.
Universal Road Mchy. Co., Kingston, N. Y.—stone, sand and gravel—300
Warner Laboratories, Cresson Pa.—294
Watson-Flagg Eng. Co., Paterson, N. J.—278
Ralph O. Watson Company, Anaconda, Mont.
Webb City & Carterville Fdy. & Mach. Works, Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
The Wellman-Seaver-Morgan Co., Cleveland, O.
Western Precipitation Co., Los Angeles, Calif.—chemical
A. R. Wilfley & Sons, Denver, Colo.—19
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5
R. D. Wood & Co., Philadelphia, Pa.—288
Worthington Pump and Machinery Corp., New York, N. Y.

ENGINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—steam and diesel—225
American Blower Co., Detroit, Mich.—vertical steam
American Car and Fdy. Co., New York, N. Y.—gasoline
American Hoist & Derrick Co., St. Paul, Minn.—steam, gasoline, kerosene and oil—298
Anderson Engine & Fdry. Co., Anderson, Ind.—diesel engines
Armstrong Mfg. Co., Waterloo, Ia.—gasoline, kerosene and oil—55
Automatic Machine Co., Bridgeport, Conn.—gasoline
Earle C. Bacon, Inc., New York, N. Y.—hoisting—275
Beaver Mfg. Co., Milwaukee, Wis.
The Bessemer Gas Engine Co., Grove City, Pa.—gas, oil and diesel
Bethlehem Steel Co., Bethlehem, Pa.—oil
The Brownell Co., Dayton, O.—steam
The Buckeye Machine Co., Lima, O.
The Buda Co., Harvey, Ill.—gasoline
The Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.—full liesel
Charter Gas Engine Co., Sterling, Ill.—gasoline, gas, kerosene and oil
Chicago Pneumatic Tool Co., New York, N. Y.—gas, oil
Climax Engineering Co., Clinton, Ia.—gasoline and kerosene—94
Clyde Iron Works, Duluth, Minn.—gasoline,
Continental Motors Corp., Detroit, Mich.—gasoline, kerosene and oil
steam and belt hoisting
The Cook Motor Co., Delaware, O.—gas, gasoline and kerosene—280
Cummins Engine Co., Columbus, Ind.—diesel
De La Vergne Machine Co., New York, N. Y.—oil, diesel—297
Dodge Mfg. Co., Mishawaka, Ind.
Domestic Engine & Pump Co., Shippensburg, Pa.—gasoline
Ellicott Machine Corp., Baltimore, Md.—dredge and marine
Erie City Iron Works, Erie, Pa.—steam
Erie Engine Works, Erie, Pa.—steam
Erie Pump and Engine Works—Medina, N. Y.—steam—292
Fairbanks, Morse & Co., Chicago, Ill.—gasoline and diesel—Insert bet. 72-73
Falk Corp., Milwaukee, Wis.—Insert bet. 232-233
S. Flory Mfg. Co., Bangor, Pa.—hoisting derrick—304
The Foos Gas Engine Co., Springfield, O.—internal combustion
Forsythe Bros., New York, N. Y.—hoisting
Fulton Iron Works Co., St. Louis, Mo.—diesel
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61

ENGINES—Cont'd

Hadfield-Penfield Steel Co., Bucyrus, O.—diesel 271 and 300
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hercules Motors Corp., Canton, O.—gas, kerosene and oil—internal combustion—90-91
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.—steam
Hill Diesel Engine Co., Lansing, Mich.—diesel oil
C. W. Hunt Co., Inc., West New Brighton, N. Y.
Ideal Engine Co., Lansing, Mich.—gas
Ingersoll-Rand Co., New York, N. Y.—oil, steam and gas—Insert bet. 48-49
Jackson & Church Co., Saginaw, Mich.—257
Kahlenberg Bros. Co., Two Rivers, Wis.—oil
Robert P. Kehoe, New York, N. Y.—oil and diesel
The Komnick Machy. Co., Detroit, Mich.—278 and 301
Lansing Motor & Pump Co., Lansing, Mich.—hoisting
Lidgerwood Mfg. Co., New York, N. Y.—steam, electric and gasoline—64
McIntosh and Seymour Corp., Auburn, N. Y.—semi-diesel
Manitowoc Eng. Corp., Manitowoc, Wis.—293
Mead-Morrison Mfg. Co., E. Boston, Mass.—haulage, hoisting, etc.—75
Mianus Diesel Engine Co., Stamford, Conn.—diesel
Mine and Smelter Supply Co., Denver, Colo.—Inside back cover
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
Morris Mach. Works, Baldwinsville, N. Y.—steam
Muncie Oil Engine Co., Muncie, Ind.—vertical diesel
The Mundy Sales Corp., New York, N. Y.—16
Murray Iron Works Co., Burlington, Ia.—steam
New Holland Machine Co., New Holland, Pa.—gas—283
Nordberg Mfg. Co., Milwaukee, Wis.—steam and oil—297
Novo Engine Co., Lansing, Mich.—gasoline, gas and kerosene—236
Orr & Sembower, Reading, Pa.—steam, electric and gasoline hoisting
The Otto Engine Works, Philadelphia, Pa.—gas, gasoline, oil
The Power Mfg. Co., Marion, O.—oil—242
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Ross Power Equipment Co., Indianapolis, Ind.—oil, steam, and gasoline
Ruston & Hornsby, Ltd., Lincoln, England—gas, oil, steam
The Sanderson-Cyclone Drill Co., Orrville, O.—industrial gasoline—17
Schramm, Inc., West Chester, Pa.—gasoline
The T. L. Smith Co., Milwaukee, Wis.—gas
The St. Mary's Oil Engine Co., St. Charles, Mo.—diesel
The Standard Scale & Supply Corp., Pittsburgh, Pa—gasoline
H. N. Strait Mfg. Co.—Kansas City, Kans.—gas
B. F. Sturtevant Co., Boston, Mass.—steam
Superior Iron Works, Superior, Wis.—steam
Universal Motor Co., Oshkosh, Wis.—gas
Universal Road Mch. Co., Kingston, N. Y.—300
Venn Severin Machine Co., Chicago, Ill.—oil
Waukesha Motor Co., Waukesha, Wis.—gas, gasoline, kerosene
Wisconsin Motor Mfg. Co., Milwaukee, Wis.—gasoline
Worthington Pump & Machinery Corp., New York, N. Y.—oil, diesel, gasoline and kerosene

EVAPORATORS

Dodge Manufacturing Corp., Mishawaka, Ind.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

EXCAVATING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—underground shovels—225
American Hoist & Derrick Co., St. Paul, Minn. 298
American Manganese Steel Co., Chicago Hts., Ill.
American Mfg. & Eng. Co., Kalamazoo, Mich.—cableway
Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Blaw-Knox Co., Pittsburgh, Pa.—60
Brown Hoisting Mchy. Co., Cleveland, O.—280
Browning Crane Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—all types —Insert bet. 232-233
The Byers Machine Co., Ravenna, O.—derrick, drainage and trench—18
Cable Excavator Co., Fernwood, Pa.—dragline cableway
Clyde Iron Works, Duluth, Minn.
The Dayton Whirley Co., Dayton, O.
Erie Steam Shovel Co., Erie, Pa.—47
L. B. Foster Co., Pittsburgh, Pa.—88
The General Excavator Co., Marion, O.
Good Roads Mchy. Co., Kennett Square, Pa.—61
Harnischfeger Corporation, Milwaukee, Wis.—Insert bet. 8-9
Hayward Co., New York, N. Y.—11
Hoar Shovel Co., Duluth, Minn.
Indianapolis Cable Excavator Co., Indianapolis, Ind.—slack line

EXCAVATING MACHINERY—Cont'd

Industrial Works, Bay City, Mich.
Insley Mfg. Co., Indianapolis, Ind.
Kensington Steel Co., Chicago, Ill.—parts
Keystone Driller Co., Beaver Falls, Pa.—297
Koehring Company, Milwaukee, Wis.—dragline, crane—30-31
Robert L. Latimer & Co., Philadelphia, Pa.
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—dragline cableway —Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
McMyler Interstate Co., Cleveland, O.—40
Marion Steam Shovel Co., Marion, O.—26-27
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Monighan Machine Co., Chicago, Ill.—walking traction—7
The Mundy Sales Corp., New York, N. Y.—16
Northwest Engineering Co., Chicago, Ill.—Insert bet. 2-3
Novo Engine Co., Lansing, Mich.—236
The Ohio Power Shovel Co., Lima, O.
Orton Crane & Shovel Co., Chicago, Ill.—81
The Osgood Co., Marion, O.—301
Owen Bucket Co., Cleveland, O.—93
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Pioneer Bucket Co., Indianapolis, Ind.
Ross Power Equipment Co., Indianapolis, Ind.
Ruston & Hornsby, Ltd., Lincoln, England
Sauerman Bros., Chicago, Ill.—256
Schofield-Burkett Construction Co., Macon, Ga.
T. L. Smith Co., Milwaukee, Wis.
The Star Drilling Machine Co., Akron, O.—253
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Thew Shovel Co., Lorain, O.—Insert bet. 80-81
The Universal Crane Co., Cleveland, O.
G. H. Williams Company, Erie, Pa.—buckets

EXPLOSIVES AND BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.
General Explosives Co., Chicago, Ill.
The Giant Powder Co., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.—52
Hercules Powder Co., Wilmington, Del.—37
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

FANS

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Century Electric Co., St. Louis, Mo.
The Champion Blower & Forge Co., Lancaster, Pa.—exhaust
Clarage Fan Co., Kalamazoo, Mich.—exhaust
Clark Dust Collecting Co., Chicago, Ill.
Electric Blower Co., Boston, Mass.
Garden City Fan Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
The Kirk & Blum Mfg. Co., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—blades only—76-77
The Northern Blower Co., Cleveland, O.
The Raymond Bros. Impact Pulv. Co., Chicago, Ill.—exhaust—38-39
Ross Power Equipment Co., Indianapolis, Ind.
J. S. Schofield's Sons Co., Macon, Ga.
W. W. Sly Mfg. Co., Cleveland, O.—243
Sprout, Waldron & Co., Muncy, Pa.—298
B. F. Sturtevant Co., Boston, Mass.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., S. Pittsburgh, Pa.—258-259

FEEDERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Anchor Concrete Machy. Co., Adrian, Mich.—277
The Automatic Furnace Co., Dayton, O.—coal
Barber-Greene Co., Aurora, Ill.—coal
C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bonnot Co., Canton, O.—248
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Chain Belt Co., Milwaukee, Wis.—96
The Columbus Conveyor Co., Columbus, O.—255
W. H. Dance, Cambridge, Mass.
Dodge Mfg. Corp., Mishawaka, Ind.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Galland-Henning Mfg. Co., Milwaukee, Wis.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—apron—61
The Greenville Mfg. Co., Greenville, O.
Grindle Fuel Equipment Co., Harvey, Ill.—coal
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245

FEEDERS—Cont'd

Wilbur G. Hudson Corp., New York, N. Y.
Ideal Concrete Machy. Co., Cincinnati, O.—concrete products—239
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—apron—Back cover and 42-43
Link-Belt Meese & Gottried Co., San Francisco, Calif.
Maddox Foundry & Machine Co., Archer, Fla.
The Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Morrow Mfg. Co., Columbus, O.
The Patterson Foundry & Machine Co., East Liverpool, O.
Robins Conveying Belt Co., New York, N. Y.—249
Schaffer Engineering Co., Pittsburgh, Pa.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Smith Eng. Wks., Milwaukee, Wis.—283
Southwestern Eng. Co., Los Angeles, Calif.
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5
The Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273
Schaffer Poidometer Co., Pittsburgh, Pa.—5

FEED WATER HEATERS

Bethlehem Shipbuilding Corp., Bethlehem, Pa.
The Brownell Co., Dayton, O.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Ross Power Equipment Co., Indianapolis, Ind.
Southwestern Eng. Co., Los Angeles, Calif.
The Superheater Co., New York, N. Y.
Worthington Pump and Machinery Co., New York, N. Y.

FEED WATER REGULATORS

Atlas Valve Co., Newark, N. J.
Co-operative Utilities Co., Philadelphia, Pa.
S-C Regulator Co., Fostoria, O.

FILTER CLOTH

American Wire Fabrics Corp., New York, N. Y.
Filter Fabrics Co., Salt Lake City, Utah
Hettrick Mfg. Co., Toledo, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.—Insert bet. 264-265
Newark Wire Cloth Co., Newark, N. J.
The W. S. Tyler Co., Cleveland, O.
United Filters Corp., Hazelton, Pa.—252
Wickwire, Spencer Steel Corp., New York, N. Y.

FILTERS (Cement Slurry)

United Filters Corp., Hazelton, Pa.—252

FILTRATION SYSTEMS (For Oil)

S. F. Bowser & Co., Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65

FIRE APPARATUS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—underwriters pumps—225
Federal Electric Co., Chicago, Ill.—alarms
Foamite Childs Corporation, Utica, N. Y.
Howe Fire Apparatus Co., Anderson, Ind.
International Motor Co., New York, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa.
Safety First Supply Co., Pittsburgh, Pa.

FIRE BRICK

Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Ashland Fire Brick Co., Ashland, Ky.
Basic Products Co., St. Louis, Mo.
Betson-Jewell, Inc., Rome, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
Chicago Fire Brick Co., Chicago, Ill.
Chicago Retort & Fire Brick Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
Eastern Clay Goods Co., Boston, Mass.
Foote Mineral Co., Inc., Philadelphia, Pa.
General Refractories Co., Philadelphia, Pa.—335
A. P. Green Fire Brick Co., Mexico, Mo.—73
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Laclede-Christy Co., St. Louis, Mo.
Missouri Fire Brick Co., St. Louis, Mo.
Mitchell Clay Mfg. Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Plibrico Jointless Fire Brick Co., Chicago, Ill.
Robinson Clay Product Co., New York, N. Y.
The Chas. Taylor Sons Co., Cincinnati, O.
Thomas Moulding Brick Co., Chicago, Ill.
The Vitrefax Co., Los Angeles, Calif.
Walsh Fire Clay Products Co., St. Louis, Mo.

FIRE CLAY

(See Refractories)

FLANGES, PIPE
(See Pipe Flanges)

FLARES
Linde Air Products Co., New York, N. Y.

FORGES
Armstrong Mfg. Co., Waterloo, Ia.—55
C. C. Bradley and Sons, Syracuse, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
Denver Rock Drill Mfg. Co., Denver, Colo.—oil, for drill steel—80
Hauck Manufacturing Co., Brooklyn, N. Y.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Manitowoc Engineering Works, Manitowoc, Wis.—293
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Newhall Chain Forge & Iron Co., New York, N. Y.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.—87
W. S. Tyler Co., Cleveland, O.

FORGINGS
American Car and Fdy. Co., New York, N. Y.
American Process Co., New York, N. Y.—302
Bethlehem Steel Co., Bethlehem, Pa.
Coates Steel Products Co., Greenville, Ill.—227
Davenport Locomotive Works, Davenport, Ia.
The Duff Manufacturing Co., Pittsburgh, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hill Clutch Mach. & Fdy. Co., Cleveland, O.—302
Jackson & Church Co., Saginaw, Mich.—257
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Manitowoc Eng. Wks., Manitowoc, Wis.—293
McMyler-Interstate Co., Cleveland, O.—40
The Midvale Co., Philadelphia, Pa.—54
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
United Iron Works, Inc., Joplin, Mo.

FORMS (Concrete)
(See Concrete Molds)

FOUNDRY EQUIPMENT
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Mullins Body Corp., Salem, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51

FRICTION BLOCKS
Thomas L. Gatke, Chicago, Ill.—45

FROGS AND SWITCHES
The Aldon Co., Chicago, Ill.
American Manganese Steel Co., Chicago Hts., Ill.
Atlas Car & Mfg. Co., Cleveland, O.—260
Bethlehem Steel Co., Bethlehem, Pa.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Buda Co., Harvey, Ill.
Central Frog & Switch Co., Cincinnati, O.—302
Cincinnati Frog & Switch Co., Cincinnati, O.
Easton Car & Const. Co., Easton, Pa.—10
Egyptian Iron Works, Murphysboro, Ill.
Farrell-Cheek Steel Fdy. Co., Sandusky, O.—244
L. B. Foster Co., Pittsburgh, Pa.—88
Frog, Switch & Mfg. Co., Carlisle, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Koppel Ind. Car & Equip. Co., Koppel, Pa.—284
The Lakewood Eng. Co., Cleveland, O.
Morrison & Risman Co., Inc., Buffalo, N. Y.
Sweets Steel Co., Williamsport, Pa.—290
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Weir Frog Co., Cincinnati, O.

FUEL ECONOMIZERS
Babcock & Wilcox Co., New York, N. Y.
Power Specialty Co., New York, N. Y.
B. F. Sturtevant Co., Boston, Mass.

FUEL OIL
Standard Oil Co. of Indiana, Chicago, Ill.
Tidewater Oil Co. of New York, N. Y.

FUEL OIL SYSTEMS
Bethlehem Shipbuilding Corp., Bethlehem, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Columbian Steel Tank Co., Kansas City, Mo.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Grindle Fuel Equipment Co., Harvey, Ill.
Morse Dry Dock & Repair Co., Brooklyn, N. Y.
Smokeless Oil Burner Co., Bucyrus, O.

FURNACES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.—electric
American Gas Furnace Co., Elizabeth, N. J.
Automatic Furnace Co., Dayton, O.

FURNACES—Cont'd
W. N. Best Corp., New York, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Chapman-Stein Furnace Co., Mt. Vernon, O.
Eimer & Amend, New York, N. Y.—electric
Fuller-Lehigh Co., Fullerton, Pa.—78-79
General Chemical Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Gilbert & Barker Mfg. Co., Springfield, Mass.
Gilman Mfg. Co., E. Boston, Mass.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
K-B Pulverizer Corp., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Ludlum Steel Co., Watervliet, N. Y.—electric—305
Manitowoc Eng. Works, Manitowoc, Wis.—blast—293
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Power Specialty Co., New York, N. Y.
The Precision Scientific Co., Chicago, Ill.—testing
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Reeves Bros. Co., Alliance, O.
Sullivan Machinery Co., Chicago, Ill.—drill steel only—87
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
The Wellman-Seaver-Morgan Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259
Worthington Pump and Machinery Corp., New York, N. Y.

FURNACES (Laboratory)
Central Scientific Co., Chicago, Ill.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Precision Scientific Co., Chicago, Ill.—testing
E. H. Sargent & Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

FUSE (Blasting)
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.—Cordeau-Bickford detonating—48
The Giant Powder Co., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.—52
Hercules Powder Co., Wilmington, Del.—Cordeau-Bickford detonating—37
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

FUSES (Electrical)
Bussmann Mfg. Co., St. Louis, Mo.
Chicago Fuse Mfg. Co., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Economy Fuse & Mfg. Co., Chicago, Ill.
Federal Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

FUSES (Renewable)
Economy Fuse & Mfg. Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

GAS ENGINES
(See Engines)

GASKETS
The Booth Felt Co., Inc., Brooklyn, N. Y.
Buffalo Weaving & Belting Co., Buffalo, N. Y.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
The Diamond Rubber Co., Akron, O.
Flexitallic Gasket Co., Camden, N. J.
Garlock Packing Co., Palymra, N. Y.
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
Goodyear Tire & Rubber Co., Akron, O.
Jenkins Bros., New York, N. Y.
Johns-Manville, Inc., New York, N. Y.
McCord Radiator Mfg. Co., Inc., Detroit, Mich.
New York Belt. & Pack. Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
United States Rubber Co., New York, N. Y.—231

GASOLINE ENGINES (See Engines)
(Gasoline, Kerosene and Oil)

GAS PRODUCERS
The Chapman Engineering Co., Mt. Vernon, O.
Duff Patents Co., Inc., Pittsburgh, Pa.
Gas Producer & Engineering Corp. of New Jersey, Philadelphia, Pa.
McGann Mfg. Co., Inc., York, Pa.—254

GAS PRODUCERS—Cont'd
Morgan Construction Co., Worcester, Mass.
The Otto Engine Works, Philadelphia, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Smith Gas Eng. Co., Dayton, O.
Wellman-Seaver-Morgan Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.—288

STEAM BOILERS
(See Boilers)

GATES (Bin)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Austin Mfg. Co., Chicago, Ill.—36
Earle C. Bacon, Inc., New York, N. Y.—275
The C. O. Bartlett & Snow Co., Cleveland, O.
Beaumont Mfg. Co., Philadelphia, Pa.
The Biehl Iron Works, Inc., Reading, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.—280
H. W. Caldwell & Sons Co., Chicago, Ill.—303
The C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Conveyors Corporation of America, Chicago, Ill.
Easton Car & Construction Co., Easton, Pa.—10
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Galland-Henning Mfg. Co., Milwaukee, Wis.
The Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulv. Co., St. Louis, Mo.—245
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
The Heltzel Steel Form & Iron Co., Warren, O.—65
C. W. Hunt & Co., W. New Brighton, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., York, Pa.—254
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Morrow Mfg. Co., Columbus, O.
Palmer-Bee Co., Detroit, Mich.—6
Reeves Bros. Co., Alliance, O.
Roberts and Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns Co., Chicago, Ill.
Smith Eng. Wks., Milwaukee, Wis.—283
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
The Sykes Co., Chicago, Ill.
Thaleg & Hock, Chicago, Ill.—33
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa. 262-263
United Iron Works, Inc., Joplin, Mo.
Universal Road Machy. Co., Kingston, N. Y.—300
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

GAUGES
The Aldon Co., Chicago, Ill.
The Bristol Co., Waterbury, Conn.—recording
The Brown Instrument Co., Philadelphia, Pa.—
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
The Linde Air Products Co., New York, N. Y.
The Lunkenheimer Co., Cincinnati, O.—299
The Alexander Milburn Co., Baltimore, Md.
Oxweld Acetylene Co., New York, N. Y.—welding—4
The Prest-O-Lite Company, New York, N. Y.
Taylor Instrument Co., Rochester, N. Y.

GEAR TRANSFORMERS
(See Speed Reducers)

GEARS AND PINIONS
Albaugh-Dover Mfg. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Mang. Steel Co., Chicago Hts., Ill.
Bethlehem Fdry. & Mach. Co., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—303
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—96
The Cleveland Worm & Gear Co., Cleveland, O.—worm—82-83
The Columbus Conveyor Co., Columbus, O.—255
De Laval Steam Turbine Co., Trenton, N. J.—63

GEARS AND PINIONS—Cont'd

Dodge Mfg. Corp., Mishawaka, Ind.
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—301
The Falk Corp., Milwaukee, Wis.—spur, helical and worm—Insert bet. 232-233
Fawcus Machine Co., Pittsburgh, Pa.
The Farrell-Cheek Steel Fdy. Co., Sandusky, O. —244
Farrell Foundry & Mach. Co., Buffalo, N. Y.—herringbone and helical
Foote Bros. Gear & Machine Co., Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Fulton Iron Works Co., St. Louis, Mo.
William Ganschow Co., Chicago, Ill.—287
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hill Clutch Machine & Foundry Co., Cleveland, O.—302
The Horsburgh & Scott Co., Cleveland, O.—spur, helical and worm—286
Hubbard Steel Foundry Co., East Chicago, Ind.
D. O. James Mfg. Co., Chicago, Ill.—14-15
The Jeffrey Mfg. Co., Columbus, O.—58-59
W. A. Jones Foundry & Machine Co., Chicago, Ill. —spur, helical and worm
Kensington Steel Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Lewis Foundry & Mach. Co., Pittsburgh, Pa.—cut, helical, spur, worm
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mackintosh - Hemphill Co., Pittsburgh, Pa.—spur, helical and worm—290
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
The Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Moore Steam Turbine Co., Wellsville, N. Y.
Morgan Eng. Co., Alliance, O.
Morse Chain Co., Ithaca, N. Y.—silent chain, compensating spring—62
W. F. Mosser & Son, Allentown, Pa.
National Malleable & Steel Castings Co., Cleveland, O.—blanks
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.—spur, helical and worm—6
Pettibone-Mulliken Co., Chicago, Ill.
Philadelphia Gear Wks., Philadelphia, Pa.—265
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Engineering & Machine Co., Baltimore, Md.
Reeves Bros. Co., Alliance, O.
Robins Conveying Belt Co., New York, N. Y.—249
Sivyer Steel Casting Co., Milwaukee, Wis.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Superior Iron Works Co., Superior, Wis.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel
Terry Steam Turbine Co., Hartford, Conn.
Thaleg & Hock, Chicago, Ill.—33
Tool Steel Gear & Pinion Co., Cincinnati, O.—spur, bevel and tooth
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
Twin Disc Clutch Co., Racine, Wis.—Insert bet. 2-3
Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Inc., Joplin, Mo.
The Van Dorn & Dutton Co., Cleveland, O.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Watson-Flagg Engineering Co., Paterson, N. J. —278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
The Wellman-Seaver-Morgan Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

GENERATORS (Acetylene)

Haynes Stellite Co., New York, N. Y.
The Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., New York, N. Y.—4
The Prest-O-Lite Company, New York, N. Y.

GENERATORS (Electrical)
(See Electric Motors and Generators)

GLASS SAND EQUIPMENT

American Process Co., New York, N. Y.—302
Dorr Co., New York, N. Y.—56
Kennedy-Van Saun Engineering & Machinery Co., New York, N. Y.
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Louisville Drying Machy. Co., Louisville, Ky.—305
Stevenson Co., Wellsville, O.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263

GLOVES (Asbestos)
(See Safety Devices)

GOGGLES
(See Safety Devices)

GRAB BUCKETS
(See Buckets, Clamshell, Orangepeel, Dragline, Grab)

GRAB BUCKET CRANES
(See Cranes)

GRAB BUCKET HOISTS (Monorail)
(See Cranes)

GRADERS
(See Road Machinery)

GRAPHITE FACING

Joseph Dixon Crucible Co., Jersey City, N. J.—303
J. W. Paxson Co., Philadelphia, Pa.—50-51

GRAPPLES (Stone and Wood)

The Browning Crane Co., Cleveland, O.
Greenville Mfg. Co., Greenville, O.
The Hayward Co., New York, N. Y.—11
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Smith Engineering Wks., Milwaukee, Wis.—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Superior Iron Works, Superior, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
G. H. Williams Co., Erie, Pa.

GRATES

American Manganese Steel Co., Chicago Hts., Ill.
Arnold & Weigel, Woodville, O.—250-251
The Automatic Furnace Co., Dayton, O.
Brownell Co., Dayton, O.
Canton Grate Co., Canton, O.
Combustion Engineering Corp., New York, N. Y.
Eagle Iron Works, Des Moines, Ia.—305
Farrell-Cheek Steel Fdy. Co., Sandusky, O.—244
Gehret Bros., Inc., Bridgeport, Pa.
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Houston Stanwood & Gamble Co., Inc., Cincinnati, O.
Kramer Bros. Fdry. Co., Dayton, O.
Manitowoc Eng. Works, Manitowoc, Wis.—293
Murray Iron Works Co., Burlington, Ia.
Saxe & Heald, Chicago, Ill.
Sanford-Riley Stoker Co., Worcester, Mass.
Schaffer Engineering Co., Pittsburgh, Pa.
Steacy-Schmidt Mfg. Co., York, Pa.
Thomas Grate Bar Co., Birmingham, Ala.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.

GRATING (Steel)

Blaw-Knox Co., Pittsburgh, Pa.—60
Hendrick Mfg. Co., Carbondale, Pa.—sidewalk areaway—306
Irving Iron Works Co., Long Island City, N. Y. —subway

GREASE
(See Lubricants)

GREASE CUPS

Lunkenheimer Company, Cincinnati, O.—299

GRINDING BALLS
(See Balls, Grinding)

GRIZZLIES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Austin Mfg. Co., Chicago, Ill.—36
C. O. Bartlett & Snow Co., Cleveland, O.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chrome Steel Works, Carteret, N. J.—repair parts only—74
Galland-Henning Mfg. Co., Milwaukee, Wis.
The Good Roads Machy. Co., Inc., Kennett Square, Pa.—61
Hendrick Mfg. Co., Carbondale, Pa.—306
Wilbur G. Hudson Corp., New York, N. Y.
Jeffery Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.—parts
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Morrow Mfg. Co., Columbus, O.

GRIZZLIES—Cont'd

Pettibone-Mulliken Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—rotary—249
Rogers Foundry & Machine Co., Joplin, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
Smith Engineering Works, Milwaukee, Wis.—stationary, rotary—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
The Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273
United Iron Works, Inc., Joplin, Mo.
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233
Wickwire Spencer Steel Corp., New York, N. Y.
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

GUARDS (Machinery)

Buffalo Wire Works Co., Buffalo, N. Y.
Flexible Steel Lacing Co., Chicago, Ill.—lamp
The Harrington & King Perforating Co., Chicago, Ill.—300
Hendrick Mfg. Co., Carbondale, Pa.—396
Kirk & Blum Mfg. Co., Cincinnati, O.—gear, iron
Koppel Industrial Car & Equip. Co., Koppel, Pa.—guard rails—284
Logan Co., Louisville, Ky.
Ludlow-Saylor Wire Co., St. Louis, Mo.—Insert bet. 264-265
Watson-Flagg Eng. Co., Paterson, N. J.—278
Wickwire Spencer Steel Co., Inc., New York, N. Y.

GYPSUM BLOCK MACHINERY

Buttress Plaster Board Machy. Co., Los Angeles, Calif.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans. 301
Gypsum Eng. & Mfg. Co., Chicago, Ill.—228
Herr-Born Co., Sandusky, O.

GYPSUM AND GYPSUM PLASTER PLANTS

Butterworth & Lowe, Grand Rapids, Mich.—300
Buttress Plaster Board Machy. Co., Los Angeles, Calif.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—301
Wilbur G. Hudson Corp., New York, N. Y.
Richard K. Meade & Co., Baltimore, Md.

GYRATING SCREENS
(See Screens)

HAIR PICKERS

J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—301
Webster Mfg. Co., Chicago, Ill.

HAMMER DRILLS
(See Drills)

HAMMER MILLS
(See Crushers, Hammer)

HAND SHOVELS
(See Shovels, Hand)

HANGERS
(See Shaft Hangers)

HAULAGE SYSTEMS)
(See Electric Haulage Systems)

HEATERS
(See also Blow Torches)

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Wilwaukee, Wis.
The Brownell Co., Dayton, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
The Alexander Milburn Co., Baltimore, Md.
The Northern Blower Co., Cleveland, O.
The Precision Scientific Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—258-259

HEATING APPARATUS (Fan Systems)

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
Clarage Fan Co., Kalamazoo, Mich.
Coe Mfg. Co., Painesville, O.

HOISTING DRUMS

S. Flory Mfg. Co., Bangor, Pa.—304
Hardie-Tynes Mfg. Co., Birmingham, Ala.
The Hayward Co., New York, N. Y.—11
Manitowoc Eng. Works, Manitowoc, Wis.—steam—293
Mead-Morrison Mfg. Co., East Boston, Mass.—75
Sanford-Day Iron Works, Knoxville, Tenn.

HOISTS (Air)

Chicago Pneumatic Tool Co., New York, N. Y.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
The Denver Rock Drill Mfg. Co., Denver, Colo. —80
Detroit Hoist & Machine Co., Detroit, Mich.
Hanna Eng. Works, Chicago, Ill.
Heil Co., Milwaukee, Wis.—motor truck
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Northern Eng. Wks., Detroit, Mich.—298
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.—87
Whiting Corporation, Harvey, Ill.

HOISTS (Chain)

Roeper Crane & Hoist Works, Inc., Reading, Pa.
Wright Mfg. Co., Lisbon, O.—296

HOISTS (Hand)

American Hoist & Derrick Co., St. Paul, Minn. —298
The Cleveland Chain & Mfg. Co., Cleveland, O.
Clyde Iron Works Sales Co., Duluth, Minn.
H. D. Conkey & Co., Mendota, Ill.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Erie Hoist Co., Erie, Pa.
Ersted Mchy. Mfg. Co., Portland, Ore.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Heil Co., Milwaukee, Wis.—motor truck
Maris Brothers, Inc., Philadelphia, Pa.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Motorbloc Corp., Philadelphia, Pa.
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Roeper Crane & Hoist Works, Inc., Reading, Pa.
D. Round & Son, Cleveland, O.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
The Webster Mfg. Co., Chicago, Ill.
Wright Mfg. Co., Libson, O.—296
Yale & Towne Mfg. Co., Stamford, Conn.

HOISTS (Steam, Gasoline and Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The American Cement Mach. Co., Inc., Keokuk, Ia.
American Hoist & Derrick Co., St. Paul, Minn. —298
American Mfg. & Eng. Co., Kalamazoo, Mich.—gasoline
Earle C. Bacon, Inc., New York, N. Y.—275
The C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.—double-drum
R. H. Beaumont Co., Philadelphia, Pa.—skip
Bedford Foundry & Machine Co., Bedford, Ind.
Birmingham Rail & Loco. Co., Birmingham, Ala.
The Brown Hoisting Machinery Co., Cleveland, O.—280
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—18
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chicago Pneumatic Tool Co., New York, N. Y.
Clyde Iron Works, Duluth, Minn.
Columbian Steel Tank Works, Kansas City, Mo.
Conveyors Corp. of America, Chicago, Ill.
The Cook Motor Co., Delaware, O.—280
W. H. Dance, Cambridge, Mass.
Denver Rock Drill Mfg. Co., Denver, Colo.—pneumatic—80
Detroit Hoist and Machine Co., Detroit, Mich.—electric and monorail
Diamond Machine Co., Monongahela, Pa.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.
Drake Electric Hoist Co., Inc., Friendship, N. Y.
Easton Car & Construction Co., Easton, O.—10
Ellicott Machine Corp., Baltimore, Md.
English Bros. Steel & Machy. Co., Kansas City, Mo.
Erie Clutch & Pulley Co., Erie, Pa.
The Erie Hoist Co., Erie, Pa.
Exeter Machine Works, Inc., West Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73
S. Flory Mfg. Co., Bangor, Pa.—304
Fridy Hoist & Machinery Co., Mountville, Pa.
The Fundom Hoist & Shovel Co., Lima, O.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
The Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Mchy. Co., Kennett Square, Pa.—61
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Harnischfeger Corporation, Milwaukee, Wis.—Insert bet. 8-9
The Heil Co., Milwaukee, Wis.—truck
The Joshua Hendy Iron Works, San Francisco, Calif.
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Hyman-Michaels Co., Chicago, Ill.
Ideal Engine Co., Lansing, Mich.—gas
Industrial Works, Bay City, Mich.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Jackson & Church Co., Saginaw, Mich.—257
Jeffrey Mfg. Co., Columbus, O.—skip—58-59
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.

HOISTS (Steam, Etc.)—Cont'd

The Komnick Machinery Co., Detroit, Mich.—steam—278 and 301
Lake Shore Engine Works, Marquette, Mich.
Lambert Hoisting Engine Co., Newark, N. J.
Lansing Motor & Pump Co., Lansing, Mich.—
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—electric—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
W. C. Lipe, Inc., Syracuse, N. Y.—electric
Manning, Maxwell & Moore, Inc., New York, N. Y.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
The Marion Steam Shovel Co., Marion, O.—26-27
Maris Brothers, Inc., Philadelphia, Pa.—electric
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—friction and electric—272
The McMyler Interstate Co., Cleveland, O.—40
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
The Mine and Smelter Supply Co., Denver, Colo. —Inside back cover
Mining Machine Co., Mountville, Pa.
Motorbloc Corp., Summerdale, Philadelphia, Pa.
The Mundy Sales Corp., New York, N. Y.—16
National Hoisting Engine Co., Harrison, N. J.
Nordberg Mfg. Co., Milwaukee, Wis.—297
Northern Conveyor & Mfg. Co., Janesville, Wis.
Northern Eng. Works, Detroit, Mich.—298
Northwest Engineering Works, Chicago, Ill.—Insert bet. 2-3
Novo Engine Co., Lansing, Mich.—236
O. K. Clutch & Machinery Co., Columbia, Pa.
Orr & Sembower, Reading, Pa.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Ottumwa Iron Works, Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.—6
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Pioneer Tractors, Inc., Winona, Minn.
The Pneumelectric Corp., Syracuse, N. Y.
Rix Products Co., Milwaukee, Wis.—portable
Roeper Crane & Hoist Works, Inc., Reading, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.
Sauerman Bros., Inc., Chicago, Ill.—256
Schramm, Inc., West Chester, Pa.—compressor
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Smith Eng. Works, Milwaukee, Wis.—283
Standard Steel Works, North Kansas City, Mo.
Street Bros. Mach. Works, Chattanooga, Tenn.
Sullivan Mchy. Co., Chicago, Ill.—87
Thomas Elevator Co., Chicago, Ill.—299
United Iron Works, Inc., Joplin, Mo.
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Watson-Flagg Eng. Co., Paterson, N. J.—278
Weller Mfg. Co., Chicago, Ill.—237
Wellman-Seaver-Morgan Co., Cleveland, O.
Williamette Iron and Steel Works, Portland, Ore. —for Fordson tractor
Wood Hydraulic Hoist & Body Co., Detroit, Mich.
Wright Mfg. Co., Lisbon, O.—296
Yale and Towne Mfg. Co., Stamford, Conn.

HOOKS

American Hoist & Derrick Co., St. Paul, Minn. 298
The Columbus-McKinnon Chain Co., Columbus, O.
Crescent Belt Fastener Co., New York, N. Y.—belt—92
Macwhyte Co., Kenosha, Wis.
Newhall Chain Forge & Iron Co., New York, N. Y.
Sawyer Belt Hook Co., Pawtucket, R. I.
United States Chain & Forg. Co., Pittsburgh, Pa.
S. G. Taylor Chain Co., Chicago, Ill.
The Wellman-Seaver-Morgan Co., Cleveland, O.

HOPPERS AND SPOUTS

American Manganese Steel Co., Chicago Hts., Ill.
Atlas Car & Mfg. Co., Cleveland, O.—260
Atlas Engineering Co., Milwaukee, Wis.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Biehl Iron Works, Reading, Pa.
The Brown Hoisting Machinery Co., Cleveland, O.—280
Butler Bin Company, Waukesha, Wis.—hoppers
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Dings Magnetic Separator Co., Milwaukee, Wis. —spouts—Inside front cover
Easton Car & Construction Co., Easton, Pa.—10
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—301
Erie Steel Construction Co., Erie, Pa.
The Galion Iron Works & Mfg. Co., Galion, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Gehret Bros., Bridgeport, Pa.
The Good Roads Machy. Co., Inc., Kennett Square, Pa.—61
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Guarantee Construction Co., New York, N. Y.
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300

HOPPERS AND SPOUTS—Cont'd

Hendrick Mfg. Co., Carbondale, Pa.—306
Wilbur G. Hudson Corp., New York, N. Y.
Jackson & Church Co., Saginaw, Mich.—257
The Kirk & Blum Mfg. Co., Cincinnati, O.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.—hoppers
Magnetic Mfg. Co., Milwaukee, Wis.—magnetic spouts—291
McGann Mfg. Co., York, Pa.—254
Manitowoc Engineering Works, Manitowoc, Wis. —293
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
H. Miscampbell, Duluth, Minn.—246-247
Northern Conveyor & Mfg. Co., Janesville, Wis.
Palmer-Bee Co., Detroit, Mich.—6
J. W. Paxson Co., Philadelphia, Pa.—50-51
The Reeves Bros. Co., Alliance, O.—hoppers
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns, Chicago, Ill.—steel
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
The Sykes Co., Chicago, Ill.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Union Chain & Mfg. Co., Sandusky, O.
The Union Engineering Co., Cleveland, O.
Webb City & Carterville Fdry. & Mach. Co., Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
The Youngstown Boiler & Tank Co., Youngstown, O.

HOSE (Water, Steam, Pneumatic, Air Drill, Welding)

The Alexander Milburn Co., Baltimore, Md.—welding
The American Metal Hose Co., Waterbury, Conn. —flexible metal
Boston Woven Hose & Rubber Co., Boston, Mass.
Chicago Pneumatic Tool Co., New York, N. Y.
The Cincinnati Rubber Mfg. Co., Cincinnati, O. —235
Cleveland Rock Drill Co., Cleveland, O.
The Diamond Rubber Co., Akron, O.
Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Trenton, N. J.
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
The Goodyear Tire & Rubber Co., Akron, O.
Hardsocg Wonder Drill Co., Ottumwa, Ia.—53
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
The Linde Air Products Co., New York, N. Y.
The Manhattan Rubber Mfg. Co., Chicago, Ill.
The McIlroy Belting & Hose Co., Hammond, Ind.
Mulconroy Co., Philadelphia, Pa.
New York Belt. & Pack. Co., New York, N. Y.
New York Rubber Co., New York, N. Y.
Oxweld Acetylene Co., New York, N. Y.—4
Prest-O-Lite Company, New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
The Republic Rubber Co., Youngstown, O.
Robins Conveying Belt Co., New York, N. Y.—249
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.
W. H. Salisbury & Co., Inc., Chicago, Ill.
Schramm, Inc., West Chester, Pa.—air
Sullivan Machy. Co., Chicago, Ill.—87
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Co., New York—231
Weller Mfg. Co., Chicago, Ill.—237

HYDRATING EQUIPMENT

Arnold & Weigel, Woodville, O.—250-251
Atlas Car & Mfg. Co., Cleveland, O.—260
Blaw-Knox Co., Pittsburgh, Pa.—60
Jackson & Church Co., Saginaw, Mich.—257
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
The Komnick Mach. Co., Detroit, Mich.—278, 301
The Kritzer Co., Chicago, Ill.—303
Manitowoc Eng. Wks., Manitowoc, Wis.—293
McGann Mfg. Co., Inc., York, Pa.—254
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell Co., Duluth, Minn.—246-247
Ross Power Equipment Co., Indianapolis, Ind.
Schaffer Eng. Co., Pittsburgh, Pa.
Steacy-Schmidt Mfg. Co., York, Pa.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Vulcan Iron Works, Wilkes-Barre, Pa.—89

HYDROMETERS (Indicating and Recording)

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Phiadelphia, Pa.
Taylor Instrument Co., Rochester, N. Y.

INDICATING AND RECORDING INSTRUMENTS (Pyrometers)

The Atlas Car & Mfg. Co., Cleveland, O.—260
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.

INDICATING AND RECORDING INSTRUMENTS—Cont'd

Cleveland Instrument Co., Cleveland, O.
Chas. Engelhard, Inc., Newark, N. J.
Foxboro Co., Inc., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
E. H. Sargent Co., Chicago, Ill.
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maulen Co., New York, N. Y.

INSULATION (Electric)

General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.—258-259

INSULATION (Heat)

Armstrong Cork and Insulation Co., Pittsburgh, Pa.—brick
Botfield Refractories Co., Philadelphia, Pa.
Celite Products Co., Los Angeles, Calif.—kiln, flue, furnace, high temperature, brick, block, cement, powder, waterproofing compound—279
General Refractories Co., Philadelphia, Pa.—335
A. P. Green Fire Brick Co., Mexico, Mo.—73
Johns-Manville, Inc., New York, N. Y.
Quigley Furnace Specialties Co., New York, N. Y
F. L. Smidth & Co., Inc., New York, N. Y.—rotary kilns, etc.—69-70-71

INUNDATION SYSTEMS

Blaw-Knox Co., Pittsburgh, Pa.—60

JACKS (All Kinds)

Buda Co., Harvey, Ill.—ratchet, screen
Duff Manufacturing Co., Pittsburgh, Pa.
Robert L. Latimer & Co., Philadelphia, Pa.
Templeton, Kenly & Co., Ltd., Chicago, Ill.

KETTLES (Calcining)

(See Calcining Machinery)

KILN INSULATION

Celite Products Co., Los Angeles, Calif.—279
General Refractories Co., Philadelphia, Pa.—335

KILN LINERS

(See Refractories)

KILNS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Blower Co., Detroit, Mich.
American Process Co., New York, N. Y.—302
Arnold & Weigel, Woodville, O.—shaft—250-251
Blaw-Knox Co., Pitstburgh, Pa.—60
The Bonnot Co., Canton, O.—rotary—248
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Pa.—rotary
The Denver Fire Clay Co., Denver, Colo.
Duff Patents Co., Inc., Pittsburgh, Pa.—rotary and shaft
Glamorgan Pipe & Foundry Co., Lynchburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.—306
Hardinge Co., Inc., New York, N. Y.—66-67
W. P. Heineken, Engr., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
The Improved Equipment Co., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Lancaster Iron Works, Inc., Lancaster, Pa.—shaft
Louisville Drying Machy. Co., Louisville, Ky.—305
Manitowoc Eng. Works, Manitowoc, Wis.—293
McGann Mfg. Co., Inc., York, Pa.—rotary and vertical—254
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.—shaft and rotary—246-247
W. F. Mosser & Son, Allentown, Pa.—rotary
The Reeves Bros. Co., Alliance, O.—rotary
Ross Power Equipment Co., Indianapolis, Ind.
Ruggles-Coles (Division of Hardinge Co.), New York, N. Y.
Schaffer Engineering Co., Pittsburgh, Pa.
F. L. Smidth & Co., New York, N. Y.—rotary—69-70-71
Steacy-Schmidt Mfg. Co., York, Pa.—shaft
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—rotary—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—rotary and shaft—89
Weller Mfg. Co., Chicago, Ill.—237

KOMINUTERS

(See Mills)

LABORATORY EQUIPMENT

Braun Corp., Los Angeles, Calif.
Central Scientific Materials Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
Eimer & Amend, New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
The Precision Scientific Co., Chicago, Ill.
Riehle Testing Machine Co., Philadelphia, Pa.
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—85

LABORATORY EQUIPMENT—Cont'd

The W. S. Tyler Company, Cleveland, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.—258-259

LACING (Belt)

(See Belt Lacing)

LEAD BURNING APPARATUS

The Alexander Milburn Co., Baltimore, Md.
Oxweld Acetylene Co., New York, N. Y.—4

LIGHTS (Portable Acetylene)

Carbic Mfg. Co., Duluth, Minn.
The Macleod Co., Cincinnati, O.—contractors and flare
Alexander Milburn Co., Baltimore, Md.—carbide, contractors
Pyle National Co., Chicago, Ill.—locomotive, flood

LIME HANDLING EQUIPMENT

J. R. Alsing Engineering Co., New York, N. Y.
Arnold & Weigel, Woodville, O.—250-251
C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
The Brown Hoisting Machinery Co., Cleveland, O.—280
Chain Belt Co., Milwaukee, Wis.—96
The Dust Recovering & Conveying Co., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.—10
Fuller Co., Catasauqua, Pa.—240
Guarantee Construction Co., New York, N. Y.
George Haiss Mfg. Co., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.—58-59
Kritzer Co., Chicago, Ill.—303
Lancaster Iron Works, Inc., Lancaster, Pa.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
McGann Mfg. Co., Inc., York, Pa.—254
H. Miscampbell, Duluth, Minn.—246-247
New Holland Machine Co., New Holland, Pa.—283
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Schaffer Eng. Co., Pittsburgh, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
Union Chain & Mfg. Co., Sandusky, O.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

LIME HYDRATORS

(See Hydrating Equipment)

LIME AND HYDRATING PLANTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Arnold & Weigel, Woodville, O.—250-251
Bland Eng. Co., Minneapolis, Minn.
Blue Diamond Materials Co., New York, N. Y.—
The Bonnot Co., Canton, O.—248
A. P. McCallie, General Agent
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Komnick Machy. Co., Detroit, Mich.—278 and 301
Kritzer Co., Chicago, Ill.—303
Manitowoc Eng. Wks., Manitowoc, Wis.—93
McGann Mfg. Co., Inc., York, Pa.—254
Richard K. Meade, Baltimore, Md.
H. Miscampbell, Duluth, Minn.—246-247
The Reeves Bros. Co., Alliance, O.
Ross Power Equipment Co., Indianapolis, Ind.
Schaffer Engineering Co., Pittsburgh, Pa.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—89

LIME KILNS

(See Kilns)

LIME PACKERS

(See Bagging Machinery)

LINE SHAFT EQUIPMENT

(See Power Transmission Machinery)

LININGS

(See Mill Liners and Linings; also Chute Liners)

LOADERS (Unloaders)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Anchor Concrete Machy. Co., Adrian, Mich.—277
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp., Toledo, O.—wagon
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
Bay City Fdy. & Mach. Co., Bay City, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, O.—280
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Burch Plow Works, Crestline, O.

LOADERS—Cont'd

The Byers Machine Co., Ravenna, O.—car and wagon—18
H. W. Caldwell & Sons Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
Continental Motors Corp., Detroit, Mich.—grain.
Doolittle Stephens, Ltd., Hagersville, Ont., Can.
Dust Recov. & Convey. Co., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.—10
Elwell-Parker Electric Co., Cleveland, O.
Erie Steam Shovel Co., Erie, Pa.—47
Fairmont Mining Mchy. Co., Fairmont, W. Va.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
The Godfrey Conveyor Co., Elkhart, Ind.
Goodman Mfg. Co., Chicago, Ill.
The Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., New York, N. Y.
The Hamilton Mfg. Co., Columbus, O.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Heltzel Steel Form & Iron Co., Warren, O.—65
Hoar Shovel Co., Duluth, Minn.
Holly Pneumatic Systems, Inc., New York, N. Y.
Industrial Works, Bay City, Mich.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.—parts
Komnick Machy. Co., Detroit, Mich.—278, 301
Robert L. Latimer & Co., Philadelphia, Pa.
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—portable
Logan Co., Louisville, Ky.
Manierre Eng. & Mchy. Co., Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.—26-27
McKinney-Harrington Co., North Chicago, Ill.
The McMyler-Interstate Co., Cleveland, O.—40
Moore Speedcrane Co., Chicago, Ill.
Myers-Whaley Co., Knoxville, Tenn.
National Conveying Equipment Corp., Chicago, Ill.
N. P. Nelson Iron Works, Passaic, N. J.
New Holland Mach. Co., New Holland, Pa.—283
Nordberg Mfg. Co., Milwaukee, Wis.—297
Northern Conveyor & Mfg. Co., Janesville, Wis.
Northwest Engineering Co., Chicago, Ill.—Insert bet. 2-3
Orton Crane & Shovel Co., Chicago, Ill.—81
The Osgood Co., Marion, O.—301
Ottumwa Box Car Loader Co., Ottumwa, Ia.—box car
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Portable Machinery Co., Passaic, N. J.
Rix Products Co., Milwaukee, Wis.
Robins Conveying Belt Co., New York, N. Y.—249
Ross Power Equipment Co., Indianapolis, Ind.
James B. Seaverns Co., Chicago, Ill.
The Security Engineering Sales Co., Duluth, Minn.
T. L. Smith, Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Pa.
The Star Drilling Machine Co., Akron, O.—253
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
The Sunbury Mfg. Co., Sunbury, O.
Thaleg & Hock, Chicago, Ill.—33
Thew Shovel Co., Lorain, O.—Insert bet. 80-81
The Universal Crane Co., Cleveland, O.
Universal Road Mch. Co., Kingston, N. Y.—300
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

LOCOMOTIVES (Cable)

Interstate Equipment Corp., New York, N. Y.—24
Geo. D. Whitcomb Co., Rochelle, Ill.—305

LOCOMOTIVES (Compressed Air)

H. K. Porter Co., Pittsburgh, Pa.—261
Vulcan Iron Works, Wilkes-Barre, Pa.—89

LOCOMOTIVES (Electric and Storage Battery)

American Locomotive Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—260
Baldwin Locomotive Works, Philadelphia, Pa.
Continental Motors Corp., Detroit, Mich.
M. K. Frank, Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Goodman Mfg. Co., Chicago, Ill.
Heisler Locomotive Works, Erie, Pa.
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Hyman-Michaels Co., Chicago, Ill.
The Ironton Engine Co., Ironton, O.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Mancha Storage Battery Loco. Co., St. Louis, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259
Geo. D. Whitcomb Co., Rochelle, Ill.—305

LOCOMOTIVES (Gasoline)
American Locomotive Co., New York, N. Y.
The Atlas Car & Mfg. Co., Cleveland, O.—260
Atlas Machinery & Supply Co., Birmingham, Ala.
Austin Machinery Corp., Toledo, O.
Baldwin Locomotive Works, Philadelphia, Pa.
Bloomsburg Locomotive Works, Bloomsburg, Pa.
Brookville Locomotive Co., Brookville, Pa.—gasoline and kerosene—274
Continental Motors Corp., Detroit, Mich.
Davenport Locomotive Works, Davenport, Ia.
Easton Car & Construction Co., Easton, Pa.—10
The Fate-Root-Heath Co., Plymouth, O.—Front cover and insert bet. 272-273
Heisler Locomotive Works, Erie, Pa.
Hyman-Michaels Co., Chicago, Ill.
Industrial Equipment Co., Minster, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—284
Mid-West Loco. Wks., Cincinnati, O.—270
Milwaukee Locomotive Works, Milwaukee, Wis.
Plymouth Locomotive Works, Plymouth, O.—Front cover and insert bet. 272-273
Ross Power Equipment Co., Indianapolis, Ind.
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Geo. D. Whitcomb Co., Rochelle, Ill.—305

LOCOMOTIVES (Steam)
American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Pa.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Bloomsburg Locomotive Works, Bloomsburg, Pa.
Climax Mfg. Co., Corry, Pa.
Continental Motors Corp., Detroit, Mich.
Davenport Locomotive Works, Davenport, Ia.
Heisler Locomotive Works, Erie, Pa.
Lima Locomotive Works, Lima, O.—284
H. K. Porter Co., Pittsburgh Pa.—261
Ross Power Equipment Co., Indianapolis, Ind.
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Vulcan Iron Works Wilkes-Barre, Pa.—89
Geo. D. Whitcomb Co., Rochelle, Ill.—305

LOCOMOTIVE CRANES
(See Cranes, Caterpillar and Locomotive)

LOCOMOTIVE TIRES
Lobdell Car Wheel Co., Wilmington, Del.
The Midvale Co., Philadelphia, Pa.—54

LOG WASHERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic—Inside front cover
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.—parts
Lewistown Fdy. & Machine Co., Lewistown, Pa.—331
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Magnetic Mfg. Co., Milwaukee, Wis.—291
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Webb City & Carterville Fdry. & Mach. Works, Webb City, Mo.

LUBRICANTS (Oils and Greases)
Adam Cook's Sons Co., New York, N. Y.
American Oil Corp., Jackson, Mich.
Broderick & Bascom Rope Co., St. Louis, Mo.—wire rope—46
Cling-Surface Co., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Colonial Supply Co., Pittsburgh, Pa.
Dearborn Chemical Co., Chicago, Ill.
Joseph Dixon Crucible Co., Jersey City, N. J.—303
Fiske Bros., Refining Co., New York, N. Y.
E. J. Houghton & Co., Philadelphia, Pa.
Indian Refining Co., New York, N. Y.
Ironsides Co., Columbus, O.—wire rope and gear
Keystone Lubricating Co., Philadelphia, Pa.
A. Leschen & Sons Co., St. Louis, Mo.—wire rope—Inside back cover
Lubrication Products Co., Plainville, Conn.—291
Lunkenheimer Co., Cincinnati, O.—299
Merco Nordstrom Valve Co., San Francisco, Calif.—valve—21
Ohio Grease Co., Loudonville, O.
Standard Oil Co. of Indiana, Chicago, Ill.
The Texas Co., New York, N. Y.
Tidewater Oil Co., New York, N. Y.
Tredick Oil & Grease Co., Philadelphia, Pa.—269
Troco Lubricating Co., Inc., Philadelphia, Pa.—269
Vacuum Oil Co., New York, N. Y.

LUBRICATING SYSTEMS
S. F. Bowser & Co., Inc., Ft. Wayne, Ind.

LUBRICATING SYSTEMS—Cont'd
De Laval Steam Turbine Co., Trenton, N. J.—63
Gilbert & Barker Mfg. Co., Springfield, Mass.
Keystone Lubricating Co., Philadelphia, Pa.
The Lunkenheimer Co., Cincinnati, O.—299
Madison-Kipp Corp., Madison, Wis.
McCord Radiator & Mfg. Co., Detroit, Mich.
Ohio Grease Co., Loudonville, O.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Sanford-Day Iron Works, Knoxville, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

LUBRICATORS
S. F. Bowser & Co., Inc., Ft. Wayne, Ind.
Keystone Lubricating Co., Philadelphia, Pa.
The Lunkenheimer Co., Cincinnati, O.—299
Madison-Kipp Corp., Madison, Wis.
McCord Radiator & Mfg. Co., Detroit, Mich.
The Ohio Grease Co., Loudonville, O.

MACHINERY GUARDS
(See Guards, Machinery)

MACHINE SHOP EQUIPMENT
The Alexander Milburn Co., Baltimore, Md.
The Black & Decker Mfg. Co., Baltimore, Md.
Champion Blower & Forge Co., Lancaster, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Hill-Clarke & Co., Chicago, Ill.—machine tools
Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Manning, Maxwell & Moore, Inc., New York, N. Y.
Moore & Moore, Reading, Pa.
John A. Roebling's Sons Co., Trenton, N. J.—alligator wrenches—Insert bet. 232-233
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.—87
T. B. Wood's Sons Co., Chambersburg, Pa.—233

MAGAZINES (For Explosives)
Littleford Bros., Cincinnati, O.—portable.

MAGNETIC DEVICES
Pulleys, Separators, Drums, Concentrators, Safety Magnets, Magnetic Spouts, Special Margnets
Acme Magnetic Pulley Co., Chicago, Ill.
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—clutches, pulleys, starters, etc.—49
Dings Magnetic Separator Co., Milwaukee, Wis.—Inside front cover
Electric Controller & Mfg. Co., Cleveland, O.
S. Howes Co., Inc., Silver Creek, N. Y.
Magnetic Mfg. Co., Milwaukee, Wis.—291
New Holland Machine Co., New Holland, Pa.—283
Patterson Fdy. & Mchy. Co., East Liverpool, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Robinson Mfg. Co., Muncy, Pa.

MANGANESE STEEL PRODUCTS
American Manganese Steel Co., Chicago Hts., Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
Bethlehem Steel Co., Bethlehem, Pa.
Cling-Surface Co., Buffalo, N. Y.
Electric Manganese Steel Co., Reading, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Manganese Steel Forge Co., Philadelphia, Pa.—rolled and forged—76-77
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Moore & Moore, Reading, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33

MAN LIFTS
The Barnard Machinery Co., Enterprise, Kans.
Bland Engineering Co., Minneapolis, Minn.
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Link-Belt Meese & Gottfried Co., San Francisco, Calif.

MASKS
(See Safety Devices)

MEASURING BINS
Blaw-Knox Co., Pittsburgh, Pa.—60
Butler Bin Co., Waukesha, Wis.
Erie Steel Construction Co., Erie, Pa.
Heltzel Steel Form & Iron Co., Warren, O.—65
C. S. Johnson Co., Champaign, Ill.

MEASURING DEVICES
Blaw-Knox Co., Pittsburgh, Pa.—60
Butler Bin Co., Waukesha, Wis.
Heltzel Steel Form & Iron Co., Warren, O.—65
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Northern Conveyor & Mfg. Co., Janesville, Wis.
Roberts & Schaefer Co., Chicago, Ill.—25

MECHANICAL DRAFT APPARATUS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee. Wis.

MECHANICAL DRAFT APPARATUS—Cont'd
Buffalo Forge Co., Buffalo, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
The Kirk & Blum Mfg. Co., Cincinnati, O.

MECHANICAL RUBBER GOODS
Boston Woven Hose & Rubber Co., Boston, Mass.
Buffalo Weaving & Belting Co., Buffalo, N. Y.
Cincinnati Rubber Mfg. Co., Cincinnati, O.—235
The Diamond Rubber Co., Akron, O.
Doolittle-Stephens, Ltd., Hagersville, Ont., Can.
Empire Tire & Rubber Co. of N. J., Trenton, N. J.
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
Goodyear Tire & Rubber Co., Akron, O.
New York Belt. & Pack. Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
U. S. Rubber Co., New York, N. Y.—231

METAL (Alloys)
(See Alloys, Babbitt Metal, Manganese Steel, Steel, etc.)

METERS
(Temperature, Flow, Pressure, Speed, CO_2, Draft, Water, Oil, and Electric)
Bailey Meter Co., Cleveland, O.
The Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.
Gangamo Electric Co., Springfield, Ill.
Taylor Instrument Co., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—258-259
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Worthington Pump & Machy. Corp., New York, N. Y.—water and oil

MILL LINERS AND LININGS
Advance Foundry Co., Dayton, O.—238
American Manganese Steel Co., Chicago Hts., Ill.
Chrome Steel Works, Carteret, N. J.—74
Fuller-Lehigh Co., Fullerton, Pa.—78-79
The Jeffrey Mfg. Co., Columbus, O.—58-59
Lobdell Car Wheel Co., Wilmington, Del.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
F. L. Smidth & Co., Inc., New York, N. Y.—iron and silex—69-70-71
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

MILL LINING (Rubber)
(For Ball and Tube Mills)
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
United States Rubber Co., New York, N. Y.—231

MILLS (Grinding)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—rod, ball, pebble—225
J. R. Alsing Engineering Co., New York, N. Y.—ball, tube, pebble
American Pulverizer Co., St. Louis, Mo.
Bonnot Co., Canton, O.—248
Bradley Pulverizer Co., Allentown, Pa.—286
Brainard Pulverizer Co., Chicago, Ill.
Braun Corp., Los Angeles, Calif.
Butterworth & Lowe, Grand Rapids, Mich.—Buhr stone—300
Central Scientific Co., Chicago, Ill.
Chrome Steel Works, Carteret, N. J.—repair parts only—74
Colorado Iron Works, Denver, Colo.
Crawfordsville Machy. Co., Indianapolis, Ind.
Dixie Machinery Mfg. Co., St. Louis, Mo.—hammer—3
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—gypsum—301
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Fuller-Lehigh Co., Fullerton, Pa.—ball, tube—78-79
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Hardinge Co., Inc., New York, N. Y.—ball, conical, tube—66-67
W. P. Heineken, Engr., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
Jackson & Church Co., Saginaw, Mich.—257
Jeffrey Mfg. Co., Columbus, O.—58-59
Komnick Machy. Co., Detroit, Mich.—278 and 301
K-B Pulverizer Co., Inc., New York, N. Y.—hammer
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kent Mill Co., Brooklyn, N. Y.—276
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Mine & Smelter Supply Co., Denver, Colo.—ball and tube, rod—Inside back cover
Munson Mill Machinery Co., Inc., Utica, N. Y.—Buhr stone
The Patterson Foundry & Machine Co., East Liverpool, O.—ball and tube
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273

MILLS (Grinding)—Cont'd

Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
The Reeves Bros. Co., Alliance, O.
Robinson Mfg. Co., Muncy, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Southwestern Eng. Co., Los Angeles, Calif.
F. L. Smidth & Co., New York, N. Y.—69-70-71
Sprout, Waldron & Co., Muncy, Pa.—298
Steacy-Schmidt Mfg. Co., York, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
Vulcan Iron Works, Wilkes-Barre, Pa.—ball—89
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—Insert bet. 4-5
O. B. Wise Pulverizer Co., Knoxville, Tenn.

MIXERS

The American Cement Machine Co., Inc., Keokuk, Ia.—concrete
Anchor Concrete Machy. Co., Adrian, Mich.—batch—277
Atlas Eng. Co., Milwaukee, Wis.
Beach Mfg. Co., Charlotte, Mich.
Besser Sales Co., Chicago, Ill.
Blystone Mfg. Co., Cambridge Springs, Pa.—concrete
Buttress Plaster Board Machinery Co., Los Angeles, Calif.—gypsum
Chain Belt Co., Milwaukee, Wis.—concrete—96
Concrete Equip. Co., Holland, Mich.—concrete
Continental Motors Corp., Detroit, Mich.—concrete
The Cook Motor Co., Delaware, O.—concrete—280
Crawfordsville Machinery Co., Indianapolis, Ind. —color
W. H. Dance, Cambridge, Mass.—gasoline
Dorr Co., New York, N. Y.—slurry—56
W. E. Dunn Manufacturing Co., Holland, Mich. —concrete
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan. —301
Helm Brick Machine Co., Cadillac, Mich.—concrete
Ideal Concrete Machinery Co., Cincinnati, O.—concrete—239
Jackson & Church Co., Saginaw, Mich.—257
Kiel Machine Co., Kiel, Wis.
Knickerbocker Co., Jackson, Mich.
Koehring Company, Milwaukee, Wis.—concrete —30-31
Komnick Machy. Co., Detroit, Mich.—278 and 301
Lakewood Eng. Co., Cleveland, O.—concrete
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Manning, Maxwell & Moore, Inc., New York, N. Y.
Marsh-Capron Co., Chicago, Ill.
H. Miscampbell, Duluth, Minn.—mortar—246-247
Munson Mill Mchy. Co., Utica, N. Y.—dry products
Thomas Noble & Co., Chicago, Ill.
Orr & Sembower, Inc., Reading, Pa.
T. L. Smith Co., Milwaukee, Wis.—concrete
Robinson Mfg. Co., Muncy, Pa.
Dr. Bernhardi Sohn, Eilenburg, Germany
Sprout, Waldron & Co., Muncy, Pa.—298
The Standard Scale & Supply Corp., Pittsburgh, Pa.
Sturtevant Mill Co., Boston, Mass.—85
Union Engineering Co., Cleveland, O.—concrete

MIXING PANS

Blaw-Knox Co., Pittsburgh, Pa.—60
The Bonnot Co., Canton, O.—248
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Jackson-Church Co., Saginaw, Mich.—257
Komnick Machy. Co., Detroit, Mich.—278 and 301
Littleford Bros., Cincinnati, O.
The Patterson Foundry & Machine Co., East Liverpool, O.
Stevenson Co., Wellsville, O.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263

MOLDS (Concrete, Catch Basin, Silo and Tile)
(See Concrete Molds, All Kinds)

MORTAR COLORS

C. K. Williams & Co., Easton, Pa.

MORTAR MIXING PLANTS

Blue Diamond Materials Co., New York, N. Y.—A. P. McCallie, General Agent
H. Miscampbell, Duluth, Minn.—246-247
Dr. Bernhardi Sohn, Eilenburg, Germany

MOTORS AND GENERATORS
(See Electric Motors, etc.)

MOTOR TRUCKS

Acme Motor Truck Co., Cadillac, Mich.
O. Armleder Co., Cincinnati, O.
Autocar Co., Ardmore, Pa.
Clark Tructractor Co., Chicago, Ill.

MOTOR TRUCKS—Cont'd

Columbia Motor Truck Co., Pontiac, Mich.
Commercial Truck Co., Philadelphia, Pa.
Diamond T Motor Car Co., Chicago, Ill.
Dodge Brothers, Inc., Detroit, Mich.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73
Federal Motor Truck Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.
Four-Wheel-Drive Auto Co., Clintonville, Wis.
The Garford Motor Truck Co., Lima, O.
General Motors Truck Co., Pontiac, Mich.
Graham Brothers, Detroit, Mich.
Gramm-Bernstein Motor Truck Co., Lima, O.
Indiana Motor Truck Co., Marion, Ind.
International Motor Co., New York, N. Y.
Lee Trailer & Body Co., Chicago, Ill.—trailers
Lewis-Hall Motors Corp., Detroit, Mich.
Lincoln Electric Co., Cleveland, O.
The Nash Motors Co., Kenosha, Wis.
The Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Truck Sales Corp., Alma, Mich.
Service Motors, Inc., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Titian Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
U. S. Motor Truck Co., Covington, N. Y.
The Warford Corporation, New York, N. Y.
The White Co., Cleveland, O.

MOTORS AND GENERATORS (Electric)
(See Electric Power Equipment)

NIPPLES (Pipe)

The Cleveland Rock Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Dixon Valve & Coupling Co., Philadelphia, Pa.
Knox Mfg. Co., Phiadelphia, Pa.
The Lunkenheimer Co., Cincinnati, O.—299

NITROGEN

The Linde Air Products Co., New York, N. Y.

NOZZLES (Hose)

American Spiral Pipe Works, Chicago, Ill.—boiler
Dixon Valve & Coupling Co., Philadelphia, Pa.
Knox Mfg. Co., Philadelphia, Pa.
The Lunkenheimer Co., Cincinnati, O.—299

NUGGETS (Tubemill, Grinding)

Advance Foundry Co., Dayton, O.—238
Coates Steel Products Co., Greenville, Ill.—221

OIL
(See Lubricants)

OIL BURNERS)

Aeroil Burner Co., Inc., Union City, N. J.
Babcock & Wilcox Co., New York, N. Y.
F. Beers & Co., Newark, N. J.
W. N. Best Corp., New York, N. Y.
Bethlehem Ship Building Corp., Bethlehem, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
The Denver Fire Clay Co., Denver, Colo.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hauck Mfg. Co., Brooklyn, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Littleford Bros., Cincinnati, O.
The Macleod Co., Cincinnati, O.
The Alexander Milburn Co., Baltimore, Md.
Morse Dry Dock & Repair Co., Brooklyn, N. Y.
W. S. Ray Mfg. Co., San Francisco, Calif.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Smokeless Oil Burner Co., Bucyrus, O.
Tate-Jones & Co., Pittsburgh, Pa.

OIL ENGINES
(See Engines)

OIL FORGES)
(See Forges, Oil)

OILERS (Air Line)

Denver Rock Drill Mfg. Co., Denver, Colo.—80
The Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273

ORE JIGS

McLanahan Stone Machine Co., Hollidaysburg, Pa.—272
The Mine & Smelter Supply Co., Denver, Colo.—Inside back cover

OXY-ACETYLENE APPARATUS

Haynes Stellite Co., New York, N. Y.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., New York, N. Y.—4
The Prest-O-Lite Co., New York, N. Y.

OXYGEN GAS

Air Reduction Sales Co., New York, N. Y.
The Linde Air Products Co., New York, N. Y.

PACKINGS

The Booth Felt Co., Inc., Brooklyn, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass.
Buffalo Weaving & Belting Co., Buffalo, N. Y.
Cincinnati Rubber Mfg. Co., Cincinnati, O.—235
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.

PACKINGS—Cont'd

The Diamond Rubber Co., Akron, O.
Empire Tire & Rubber Corp., Trenton, N. J.—rubber
The Garlock Packing Co., Palmyra, N. Y.
B. F. Goodrich Rubber Co., Akron, O.—all kinds —Insert bet. 4-5
The Goodyear Tire & Rubber Co., Inc., Akron, O.
The Graton & Knight Mfg. Co., Worcester, Mass. —leather
Greene, Tweed & Co., New York, N. Y.
Jenkins Bros., New York, N. Y.
Johns-Manville, Inc., New York, N. Y.—asbestos
The Manhattan Rubber Mfg. Co., Chicago, Ill.—rubber
Manning, Maxwell & Moore, Inc., New York, N. Y.
N. Y. Belting & Packing Co., New York, N. Y.
New York Rubber Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
The Republic Rubber Co., Youngstown, O.—sheet
W. H. Salisbury & Co., Inc., Chicago, Ill.
Chas. A. Schieren Co., New York, N. Y.—ammonia, hydraulic, leather
Thermoid Rubber Co., Trenton, N. J.—asbestos sheet
United States Rubber Co., New York, N. Y.—231

PACKING MACHINERY
(See Bagging Machinery)

PAINTS (Industrial)

Joseph Dixon Crucible Co., Jersey City, N. J.—303
E. I. du Pont de Nemours Co., Wilmington, Del.
Goheen Corp. of N. J., Newark, N. J.
The Metro-Nite Co., Milwaukee, Wis.
New Jersey Zinc Co., New York, N. Y.
Nitrose Co., Peoria, Ill.—acid and heat resisting

PALLETS (Concrete Products)

Commercial Shearing & Stamping Co., Youngstown, O.
A. J. Heskett Concrete Machy. Co., Williamsport, Pa.—68
Ideal Concrete Machy. Co., Cincinnati, O.—239
Youngstown Pressed Steel Co., Warren, O.

PANS (Grinding)

Bonnot Co., Canton, O.—248
Chrome Steel Works, Carteret, N. J.—74
Eagle Iron Works, Des Moines, Ia.—305
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Jackson & Church Co., Saginaw, Mich.—257
Kensington Steel Co., Chicago, Ill.—parts
The Kirk & Blum Mfg. Co., Cincinnati, O.
The Komnick Machinery Co., Detroit, Mich.—278 and 301
Lewistown Foundry & Machine Co., Lewistown, Pa.—wet and dry—331
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Patterson Fdy. & Mch. Co., E. Liverpool, O.
The Stevenson Co., Wellsville, O.
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263

PAPER CAR LINERS

Chase Bag Co., Cleveland, O.
Interstate Bag Co., Walden, N. Y.—305
W. A. Johns Paper Co., Chicago, Ill.
The Kennedy Car Liner & Bag Co., Shelbyville, Ind.

PAVERS
(See also Road Machinery)

Chain Belt Co., Milwaukee, Wis.—96
Foote Concrete Machy. Co., Nunda, N. Y.
Kensington Steel Co., Chicago, Ill.—parts
Koehring Company, Milwaukee, Wis.—30-31

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
H. W. Caldwell & Sons Co., Chicago, Ill.—303
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Perforating Co., Chicago, Ill.—304
Cross Engineering Co., Carbondale, Pa.—273
Galland-Henning Mfg. Co., Milwaukee, Wis.
Harrington & King Per. Co., Chicago, Ill.—300
Hendrick Mfg. Co., Carbondale, Pa.—306
S. Howes & Co., Silver Creek, N. Y.
Johnston & Chapman Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati O.
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Nortmann-Duffke Co., Milwaukee, Wis.
The Reeves Bros. Co., Alliance, O.
Rogers Foundry & Machine Co., Joplin, Mo.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
United Iron Works, Inc., Joplin, Mo.
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wickwire-Spencer Steel Corp., New York, N. Y.

PILE DRIVERS

American Hoist & Derrick Co., St. Paul, Minn. —298
Brown Hoisting Mchy. Co., Cleveland, O.—280
The Browning Crane Co., Cleveland, O.

PILE DRIVERS—Cont'd

Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
The Byers Machine Co., Ravenna, O.—18
The Dayton Whirley Co., Dayton, O.
Erie Steam Shovel Co., Erie, Pa.—47
Harnischfeger Corp., Milwaukee, Wis.—gasoline —Insert bet. 8-9
Industrial Works, Bay City, Mich.
Lidgerwood Mfg. Co., New York, N. Y.—64
The McMyler-Interstate Co., Cleveland, O.—40
The Mundy Sales Corp., New York, N. Y.—16
Novo Engine Co., Lansing, Mich.—236
Ohio Locomotive Crane Co., Bucyrus, O.—282
Orton Crane & Shovel Co., Chicago, Ill.—81
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnishfeger Corp.)—Insert bet. 8-9
Thaleg & Hock, Chicago, Ill.—33

PINION PULLERS

The Duff Mfg. Co., Pittsburgh, Pa.

PINIONS
(See Gears)

PIPE

Albert & Davidson Pipe Corp, Brooklyn, N. Y.
American Car & Foundry Co., New York, N. Y.
American Rolling Mill Co., Middletown, O.—ingot—special analysis steel dredge—8
American Spiral Pipe Works, Chicago, Ill.—spiral riveted
The Biggs Boiler Works Co., Akron, O.—steel riveted
Blaw-Knox Co., Pittsburgh, Pa.—60
Burch Plow Works, Crestline, O.—cast iron
A. M. Byers Co., Pittsburgh, Pa.
Chase Brass Co., Waterbury, Conn.
Chicago Bridge & Iron Works, Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Crane Co., Chicago, Ill.
L. B. Foster Co., Inc., Pittsburgh, Pa.—88
The Galion Iron Works & Mfg. Co., Galion, O.
Glamorgan Pipe & Foundry Co., Lynchburg, Va. —cast iron
Hadfield-Penfield Steel Co., Bucyrus, O.—special —271 and 300
Joshua Hendy Iron Works, San Francisco, Calif.
The Kirk & Blum Mfg. Co., Cincinnati, O.
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—dredge, pontoon and land—76-77
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Naylor Spiral Pipe Co., Chicago, Ill.—241
Petroleum Iron Wks. Co. of Ohio, Sharon, Pa.
Reading Iron Co., Reading, Pa.
Reeves Bros. Co., Alliance, O.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
United Lead Co., New York, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
R. D. Wood & Co., Philadelphia, Pa.—288

PIPE FLANGES (Steel)

American Spiral Pipe Works, Chicago, Ill.
Naylor Spiral Pipe Co., Chicago, Ill.—forged, rolled—241

PIPE SLEEVES
(See Dredge Sleeves)

PLASTER MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Process Co., New York, N. Y.—302
Butterworth & Lowe, Grand Rapids, Mich.—300
Buttress Plaster Board Mach. Co., Los Angeles, Calif.—plaster board and plaster lath, composition lath
Coe Mfg. Co., Painesville, O.—plaster and wallboard
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan. —301
The Her-Born Eng. & Mfg. Co., Sandusky, O.
M. D. Knowlton Co., Rochester, N. Y.—268
Union Engineering Co., Cleveland, O.

PLATES (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Biehl Iron Works, Inc., Reading, Pa.
Blaw-Knox Co., Pittsburgh, Pa.—60
Bollinger-Andrews Const. Co., Pittsburgh, Pa. —304
Central Frog & Switch Co., Cincinnati, O.—302
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Chrome Steel Works, Carteret, N. J.—steel, special analysis—74
Duff Patents Co., Inc., Pittsburgh, Pa.
Eddystone Steel Co., Crum Lynne, Pa.
Engineering Products Co., Chicago, Ill.
L. B. Foster Co., Pittsburgh, Pa.—tie—88
Fuller-Lehigh Co., Fullerton, Pa.—all kinds—78-79
The Hanson Clutch & Machy. Co., Tiffin, O.—base
Kensington Steel Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
McMyler-Interstate Mfg. Co., Cleveland, O.—40
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
Morrison & Risman Co., Inc., Buffalo, N. Y.—

PLATES (Steel)—Cont'd

The Reeves Bros. Co., Alliance, O.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Sivyer Steel Casting Co., Milwaukee, Wis.
Steacy-Schmidt Mfg. Co., York, Pa.
Sturtevant Mill Co., Boston, Mass.—85
Webster Mfg. Co., Chicago, Ill.
T. B. Wood's Sons Co., Chambersburg, Pa.—233

PLUG VALVES
(See Valves)

PNEUMATIC DRILLS
(See Drills)

PORTABLE CONVEYORS

Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—36
Austin-Western Road Machinery Co., Chicago, Ill.
Barber-Greene Co., Aurora, Ill.
The Burch Plow Works Co., Crestline, O.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Dodge Manufacturing Corp., Mishawaka, Ind.
Dust Recovering & Conveying Co., Cleveland, O.
Fuller Co., Catasauqua, Pa.—240
The Galion Iron Works & Mfg. Co., Galion, O.
Godfrey Conveyor Co., Elkhart, Ind.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
George Haiss Mfg. Co., New York, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.—45
Jeffrey Mfg. Co., Columbus, O.—58-59
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt, Meese & Gottfried Co., San Francisco, Calif.
Logan Co., Louisville, Ky.
The Northern Blower Co., Cleveland, O.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—249
Ross Power Equipment Co., Indianapolis, Ind.
Specialty Engineering Co., Philadelphia, Pa.
Standard Conveyor Co., N. St. Paul, Minn.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
The Webster Mfg. Co., Chicago, Ill.

PORTABLE LOADERS
See Loaders (Unloaders)

POWER DRIVES
(See Drives)

POWER SHOVELS
(Steam, Gasoline, Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Hoist & Derrick Co., St. Paul, Minn. —298
Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.—tractor
Birmingham Rail & Loco. Co., Birmingham, Ala.
Brown Hoisting Mchy. Co., Cleveland, O.—280
Browning Crane Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—Insert 232-233
Byers Machine Co., Ravenna, O.—18
Erie Steam Shovel Co., Erie, Pa.—47
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan. —301
The Fundom Hoist & Shovel Co., Lima, O.—gas and electric
The General Excavator Co., Marion, O.
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
Hoar Shovel Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
Insley Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.—58-59
Keystone Driller Co., Beaver Falls, Pa.—297
Koehring Company, Milwaukee, Wis.—30-31
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Marion Steam Shovel Co., Marion, O.—26-27
McMyler-Interstate Co., Cleveland, O.—40
Mead-Morrison Mfg. Co., E. Boston, Mass.—75
Monighan Machine Co.—Chicago, Ill.—7
Moore Speedcrane Co., Chicago, Ill.—44
Myers-Whaley Co., Knoxville, Tenn.
Nordberg Mfg. Co., Milwaukee, Wis.—air—297
Northwest Eng. Co., Chicago, Ill.—Insert bet. 2-3
The Ohio Power Shovel Co., Lima, O.
Orton Crane & Shovel Co., Chicago, Ill.—81
Osgood Co., Marion, O.—301
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Ross Power Equipment Co., Indianapolis, Ind.
The Russell & Co., Massillon, O.
Ruston & Hornsby, Ltd., Lincoln, England
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Speeder Machinery Corp., Fairfield, Ia.
The Star Drilling Machine Co., Akron, O.—253
Thew Shovel Co., Lorain, O.—Insert bet. 80-81
The Universal Crane Co., Cleveland, O.

POWER TRANSMISSION MACHINERY

Albaugh-Dover Mfg. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225

POWER TRANSMISSION MCHY.—Cont'd

American Manganese Steel Co., Chicago Hts., Ill.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
Bird Machine Co., South Walpole, Mass.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.
W. E. Caldwell Co., Louisville, Ky.
H. W. Caldwell & Sons Co., Chicago, Ill.—303
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Cleveland Worm & Gear Co., Cleveland, O.—82-83
Colonial Supply Co., Pittsburgh, Pa.
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan. —301
Fafnir Bearing Co., New Britain, Conn.—ball bearing, hanger boxes, pillow blocks, etc.—Insert bet. 2-3
Falk Corporation, Milwaukee, Wis.—Insert bet. 232-233
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., Chicago, Ill.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Wm. Ganschow Co., Chicago, Ill.—287
General Electric Co., Schenectady N. Y.—Insert bet. 64-65
Gifford-Wood Co., Hudson, N. Y.
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
The Hanson Clutch & Machinery Co., Tiffin, O.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302
Howe Chain Co., Muskegon, Mich.
Hyatt Roller Bearing Co., Newark, N. J.—12-13
D. O. James Mfg. Co., Chicago, Ill.—14-15
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
The Kritzer Co., Chicago, Ill.—303
Robert L. Latimer & Co., Philadelphia, Pa.
Lewellen Mfg. Co., Columbus, Ind.—variable speed
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, (Quincy), Mass.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Morse Chain Co., Ithaca, N. Y.—silent chain, power—62
W. F. Mosser & Son, Allentown, Pa.
Munson Mill Machinery Co., Inc., Utica, N. Y.
New Departure Co., Bristol, Conn.
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
Robert L. Latimer & Co., Philadelphia, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Phillips Pressed Steel Pulley Works, Philadelphia, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
Palmer-Bee Co., Detroit, Mich.—6
Poole Engineering & Machine Co., Baltimore, Md.
Robinson Mfg. Co., Muncy, Pa.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S. K. F. Co., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.—298
Standard Steel and Bearing Co., Plainville, Conn.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
F. L. Smidth & Co., Inc., New York, N. Y.—Lenix short center belt drive—69-70-71
Smith & Serrell, Newark, N. J.
Stearns-Roger Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—85
Timken Roller Bearing Co., Canton, O.—229
Tool Steel Gear & Pinion Co., Cincinnati, O.
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
Union Eng. Co., Cleveland, O.
Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Inc., Joplin, Mo.
Vulcan Iron Works, Wilkes, Barre, Pa.—89
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
T. B. Wood's Sons Co., Chambersburg, Pa.—233

POWER UNITS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Beaver Mfg. Co., Milwaukee, Wis.
Buda Mfg. Co., Harvey, Ill.
Climax Eng. Co., Clinton, Ia.—94
Continental Motors Corp., Detroit, Mich.
Cook Motor Co., Delaware, O.—280
Fairbanks, Morse & Co., Chicago, Ill.—electric and gasoline—Insert bet. 72-73
Ford Motor Co., Detroit, Mich.—gasoline.
General Electric Co., Schenectady, N. Y.—electric—Insert bet. 64-65
Hercules Motors Corp., Canton, O.—gasoline—90-91
Novo Engine Co., Lansing, Mich.—gasoline—236
The Power Manufacturing Co., Marion, O.—242

POWER UNITS—Cont'd

Ross Power Equipment Co., Indianapolis, Ind.
Twin Disc Clutch Co., Racine, Wis.—take-off—Insert bet. 2-3
The Warford Corporation, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—electric—258-259
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

PRECIPITATION EQUIPMENT (Electrical)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—258-259
Western Precipitation Co., Los Angeles, Calif.

PRESSES (Filter and Sagger)

Patterson Fdy. and Mach. Co., East Liverpool, O.

PRESSURE BLOWERS

Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
The Connersville Blower Co., Connersville, Ind.
De Laval Steam Turbine Co., Trenton, N. J.—63
The Kirk & Blum Mfg. Co., Cincinnati, O.
The Northern Blower Co., Cleveland, O.

PROSPECTING MACHINERY

Armstrong Mfg. Co., Waterloo, Ia.—55
Keystone Drilling Co., Beaver Falls, Pa.—297
Loomis Machine Co., Tiffin, O.—20
Sanderson Cyclone Drill Co., Orville, O.—17
Sullivan Machinery Co., Chicago, Ill.—87

PULLEYS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Pulley Co., Philadelphia, Pa.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.
C. G. Buchanan Co., Inc., New York, N. Y.—magnetic—34-35
Buttress Plaster Board Mach. Co., Los Angeles, Calif.—variable speed.
H. W. Caldwell & Son Co., Chicago, Ill.—303
W. E. Caldwell Co., Louisville, Ky.—friction clutch.
The Columbus Conveyor Co., Cleveland, O.—255
R. & J. Dick Co., Inc., Passaic, N. J.—steel split
Dodge Mfg. Co., Mishawaka, Ind.—friction, clutch, wood, iron, and steel.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Galland-Henning Mfg. Co., Milwaukee, Wis.
The Hanson Clutch & Mchy. Co., Tiffin, O.—
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—302
W. A. Jones Fdry. & Machine Co., Chicago, Ill.—friction clutch, iron, solid and split.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Medart Co., St. Louis, Mo.
Morgan Eng. Co., Alliance, O.
Munson Mill Machinery Co., Utica, N. Y.
O. K. Clutch & Machinery Co., Columbia, Pa.—clutch, friction and positive
Palmer-Bee Co., Detroit, Mich.—6
Philip Pressed Steel Pulley Works, Philadelphia, Pa.—split steel
A. Plamondon Mfg. Co., Chicago, Ill.
The Power Manufacturing Co., Marion, O.—242
Robinson Mfg. Co., Muncy, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Union Chain & Mfg. Co., Sandusky, O.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—friction clutch—237
T. B. Wood's Sons Co., Chambersburg, Pa.—233

PULLEYS (Magnetic)

(See Magnetic Pulleys)

PULVERIZED COAL SYSTEMS

(See Coal Pulverizing Equipment

PULVERIZERS

Acme Road Mchy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
J. R. Alsing Engineering Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
American Pulverizer Co., St. Louis, Mo.
The C. O. Bartlett & Snow Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
The Bonnot Co., Canton, O.—248
Bradley Pulverizer Co., Allentown, Pa.—286
Brainard Pulverizer Co., Chicago, Ill.—hammermill and fine grinding
Day Pulverizer Co., Knoxville, Tenn.
Dixie Machinery Mfg. Co., St. Louis, Mo.—3
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Grindle Fuel Equipment Co., Harvey, Ill.—unit
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—ring roll—245
Hardinge Company, Inc., New York, N. Y.—66-67

PULVERIZERS—Cont'd

Alfred Herbert, Ltd., Coventry, England—coal
Jackson & Church Co., Saginaw, Mich.—257
The Jeffrey Mfg. Co., Columbus, O.—58-59
K-B Pulverizer Corp., New York, N. Y.—"Pulverburner," all kinds
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Kensington Steel Co., Chicago, Ill.—parts
Kent Mill Co., Brooklyn, N. Y.—276
Komnick Machy. Co., Detroit, Mich.—278 and 301
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Munson Mill Machinery Co., Utica, N. Y.
New Holland Mach. Co., New Holland, Pa.—283
The Patterson Fdy. & Mch. Co., E. Liverpool, O.
Pennsylvania Crusher Co., Philadelphia, Pa.—Insert bet. 272-273
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Riley Stoker Corp., Worcester, Mass.
Ross Power Equipment Co., Indianapolis, Ind.
Steacy-Schmidt Mfg. Co., York, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
F. L. Smidth & Co., New York, N. Y.—69-70-71
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Universal Crusher Co., Cedar Rapids, Ia.—276
Universal Road Mchy. Co., Kingston, N. Y.—300
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5
O. B. Wise Pulverizer Co., Knoxvill, Tenn.

PUMPS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—air slurry and centrifugal—225
Aldrich Pump Co., Allentown, Pa.
American Air Compressor Works, Brooklyn, N. Y.—vacuum
American Manganese Steel Co., Chicago Heights, Ill.—dredging, sand and gravel
American Steam Pump Co., Beattle Creek, Mich.
The American Well Works, Aurora, Ill.—centrifugal and deep well, gravel washing, quarry, sump
Aurora Pump & Mfg. Co., Aurora, Ill.—deep well and turbine.
The Barnes Mfg. Co., Mansfield, O.—water supply and drainage
Beach Mfg. Co., Charlotte, Mich.
W. H. K. Bennett, M. E., Chicago, Ill.
Bethlehem Ship Building Corp., Bethlehem, Pa.—fuel-oil, turbo-feed, lubrication feed, condensate and centrifugal
Buffalo Forge Co., Buffalo, N. Y.
Buffalo Steam Pump Co., Buffalo, N. Y.
Carthage Fdry. & Mach. Works, Carthage, Mo.—282
Chicago Pneumatic Tool Co., New York, N. Y.—vacuum, air lift
Colorado Iron Works, Denver, Colo.—diaphragm
The Connersville Blower Co., Connersville, Ind.—rotary, for liquids and vacuums
Continental Motors Corp., Detroit, Mich.
A. D. Cook, Inc., Lawrenceburg, Ind.—deep well, steam and power-driven
The Cook Motor Co., Delaware, O.—centrifugal, force—280
Dayton-Dowd Co., Quincy, Ill.
O. H. Davidson Equipment Co., Denver, Colo.
Dean Bros. Co., Indianapolis, Ind.—piston and plunger
Dean Hill Pump Co., Anderson, Ind.—centrifugal, deep well
De Laval Steam Turbine Co., Trenton, N. J.—centrifugal—63
J. P. Devine Co., Buffalo, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.—force, trench, centrifugal and well
Dorr Co., New York, N. Y.—diaphragm—56
Edson Mfg. Corp., Boston, Mass.—diaphragm
Ellicott Machine Corp., Baltimore, Md.—dredging, sand and gravel
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.—centrifugal, sand and gravel, boiler feed and quarry—292
Evinrude Motor Co., Milwaukee, Wis.—centrifugal, high pressure 1½-2 in.
Exeter Machine Works, Inc., W. Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.—centrifugal, piston and plunger—Insert bet. 72-73
Fairmont Mining Mchry. Co., Fairmont, W. Va.
Fuller Co., Catasauqua, Pa.—air, cement—240
Fuller-Lehigh Co., Fullerton, Pa.—pulverized fuel, air—78-79
Gilbert & Barker Mfg. Co., Springfield, Mass.—gas and oil
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—centrifugal
Goulds Pumps, Inc., Seneca Falls, N. Y.—all kinds
Groch Centrifugal Floatation Co., El Paso, Tex.

PUMPS—Cont'd

Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York, N. Y.—centrifugal and direct-acting—Insert bet. 48-49
Byron Jackson Pump Mfg. Co., San Francisco, Calif.—centrifugal and turbine
Kansas City Hay Press Co., Kansas City, Mo.—sand and dredging—304
Kensington Steel Co., Chicago, Ill.
Keystone Driller Co., Beaver Falls, Pa.—297
Komnick Machy. Co., Detroit, Mich.—278 and 301
Krogh Pump & Machinery Co., San Francisco, Calif.—centrifugal sand
Lansing Motor & Pump Co., Inc., Lansing, Mich.
Lecourtenay Co., Newark, N. J.—centrifugal
The Lunkenheimer Co., Cincinnati, O.—hand oil—299
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Morris Machine Co., Baldwinsville, N. Y.
F. E. Myers & Bros. Co., Ashland, O.—all kinds
The Norbon Engineering Co., Darby, Pa.—dredge
Novo Engine Co., Lansing, Mich.—centrifugal, diaphragm, deep-well and piston (one and two cylinder double acting and triplex)—236
Nye Steam Pump & Mach. Corp., Chicago, Ill.
The Patterson Foundry & Machine Co., East Liverpool, O.—slip
Pennsylvania Pump & Compressor Co., Easton, Pa.—all kinds
Pettibone-Mulliken Co., Chicago, Ill.—dredging, sand and gravel
Pneumelectric Corp., Syracuse, N. Y.
Pulsometer Steam Pump Co., New York, N. Y.
The P. H. & F. M. Roots Co., Connersville, Ind.
Ross Power Equipment Co., Indianapolis, Ind.
Schramm, Inc., West Chester, Pa.—compressor
F. L. Smidth & Co., New York, N. Y.—slurry—69-70-71
Smokeless Oil Burner Co., Bucyrus, O.
Sullivan Machinery Co., Chicago, Ill.—air lift and dry vacuum—87
The Superheater Co., New York, N. Y.
Swaby Mfg. Co., Chicago, Ill.—centrifugal, dredging
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—centrifugal sand
Terry Steam Turbine Co., Hartford, Conn.—centrifugal
Thaleg & Hock, Chicago, Ill.—33
The Traylor Vibrator Co., Denver, Colo.—sand—Insert bet. 272-273
Union Steam Pump Co., Battle Creek, Mich.
United Iron Works, Inc., Joplin, Mo.
United Lead Co., New York, N. Y.
Universal Motor Co., Oshkosh, Wis.—centrifugal pumping set
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—centrifugal
Weinman Pump Co., Columbus, O.—centrifugal
Westco-Chippewa Pump Co., Davenport, Ia.
A. R. Wilfley & Sons, Denver, Colo.—19
Royal C. Wise, Chicago, Ill.
Worthington Pump & Mach. Corp., New York, N. Y.—power, centrifugal, steam and electric, cement slurry and sand and gravel

PYROMETERS, THERMOMETERS, TACHOMETERS

(Indicating and Recording)

The Barnard Mfg. Co., Enterprise, Kans.
Bristol Co., Waterbury, Conn.
The Brown Instrument Co., Philadelphia, Pa.
Central Scientific Co., Chicago, Ill.
Cleveland Instrument Co., Cleveland, O.
Charles Engelhard, Inc., Newark, N. J.
Foxboro Co., Inc., Foxboro, Mass.
The Leeds & Northrup Co., Philadelphia, Pa.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maeulen Co., New York, N. Y.

RAILS

Easton Car & Construction Co., Easton, Pa.—10
L. B. Foster Co., Pittsburgh, Pa.—88
Hyman-Michaels Co., Chicago, Ill.
Koppel Ind. Car & Equip. Co., Koppel, Pa.—284
Morrison & Risman, Buffalo, N. Y.
Southern Iron & Equipment Co., Atlanta, Ga.—302 and 304
Sweet's Steel Co., Williamsport, Pa.—290

RAILWAY EQUIPMENT

Aldon Co., Chicago, Ill.
American Car & Fdry. Co., New York, N. Y.
Atlas Ry. Supply Co., Chicago, Ill.
Barrett Machine Co., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birmingham Rail & Loco. Co., Birmingham, Ala.
Brown Hoisting Machy. Co., Cleveland, O.—280
Central Frog & Switch Co., Cincinnati, O.—302
The Chase Fdy. & Mfg. Co., Columbus, O.
Concrete Equip. Co., Holland, Mich.
Easton Car & Construction Co., Easton, Pa.—10
T. H. Edelblute Co., Pittsburgh, Pa.—301
Engineering Products Co., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73

RAILWAY EQUIPMENT—Cont'd
L. B. Foster Co., Pittsburgh, Pa.—88
Frog Switch & Mfg. Co., Carlisle, Pa.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Hyman-Michaels Co., Chicago, Ill.
Koppel Ind. Car & Equip. Co., Koppel, Pa.—284
The Lakewood Eng. Co., Cleveland, O.
S. W. Lindheimer Co., Chicago, Ill.
Morrison & Risman Co., Buffalo, N. Y.
Ohio Brass Co., Mansfield, O.
Sweet's Steel Co., Williamsport, Pa.—290
Weir Frog Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—258-259
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233
The Woodford Eng. Co., Chicago, Ill.—Insert bet. 232-233

RAILWAYS
(See Electrical Haulage Systems)

RECEIVERS (Air)
The Brownell Co., Dayton, O.
The Bury Compressor Co., Erie, Pa.
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Pneumatic Tool Co., New York, N. Y.
Curtis Pneumatic Mchy. Co., St. Louis, Mo.
Guarantee Construction Co., New York, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Holly Pneumatic Systems, Inc., New York, N. Y.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Littleford Bros., Cincinnati, O.
Penn. Pump & Compressor Co., Easton, Pa.
Reeves Bros., Alliance, O.
Sullivan Machinery Co., Chicago, Ill.—87
Worthington Pump & Machinery Corp., New York, N. Y.

REDUCTION GEARS
(See Speed Reducers)

REFRACTORIES
(See also Fire Brick)
Armstrong Cork & Insulation Co., Pittsburgh, Pa.
Betson-Jewell, Inc., Rome, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
Celite Products Co., Los Angeles, Calif.—279
Chapman-Stein Furnace Co., Mt. Vernon, O.
Chicago Fire Brick Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
Eastern Clay Goods Co., Boston, Mass.
General Refractories Co., Philadelphia, Pa.—335
A. P. Green Fire Brick Co., Mexico, Mo.—73
Harbison-Walker Refractories Co., Pittsburgh, Pa.
The Ironton Fire Brick Co., Ironton, O.
Johns-Manville, Inc., New York, N. Y.
Missouri Fire Brick Co., St. Louis, Mo.
Mitchell Clay Mfg. Co., St. Louis, Mo.
Parker-Russell Mining & Mfg. Co., St. Louis, Mo.
Quigley Furnace Specialties Co., New York, N. Y.
Steacy-Schmidt Mfg. Co., York, Pa.
The Vitrefax Co., Los Angeles, Calif.
Wahl Refractory Products Co., Fremont, O.

REFRACTORIES (High Alumina)
General Refractories Co., Philadelphia, Pa.—335

REGULATORS
Atlas Valve Co., Newark, N. J.
The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—speed—49
G. M. Davis Regulator Co., Chicago, Ill.—valves
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
The Linde Air Products Co., New York, N. Y.
The Alexander Milburn Co., Baltimore, Md.
Oxweld Acetylene Co., New York, N. Y.—4
The Prest-O-Lite Co., New York, N. Y.—welding
"SC" Regulator Co., Fostoria, O.

RELAYING RAILS
Atlas Car & Mfg. Co., Cleveland, O.—260
Central Frog & Switch Co., Cincinnati, O.—302
Easton Car & Construction Co., Easton, Pa.—10
L. B. Foster Co., Inc., Pittsburgh, Pa.—88
M. K. Frank, Pittsburgh, Pa.
Frog Switch & Mfg. Co., Carlisle, Pa.
Hyman-Michaels Co., Chicago, Ill.
Koppel Ind. Car & Equip Co., Koppel, Pa.—284
S. W. Lindheimer Co., Chicago, Ill.
Morrison & Risman Co., Inc., Buffalo, N. Y.

RERAILERS
(See Car Replacers)

RESPIRATORS
(See Safety Devices)

RIVETS
(See Belt Fasteners)

ROAD MACHINERY (Rollers, Graders, Spreaders, Planers, Plows, etc.)
Acme Road Mchy. Co., Frankfort, N. Y.
American Hoist & Derrick Co., St. Paul, Minn.—298
Austin Manufacturing Co., Chicago, Ill.—36
The Austin Western Road Machinery Co., Chicago, Ill.
Barber-Greene Co., Aurora, Ill.
Beach Mfg. Co., Charlotte, Mich.
Blaw-Knox Co., Pittsburgh, Pa.—60
The Brown Hoisting Machy. Co., Cleveland, O.—280
Bucyrus Company, South Milwaukee, Wis.—Insert bet. 232-233

ROAD MACHINERY—Cont'd
The Burch Plow Works Co., Chestline, O.
The Byers Mach. Co., Ravenna, O.—18
The Century Bag Cleaning Co., Cincinnati, O.
The Cleveland Rock Drill Co., Cleveland, O.
Continental Motors Corp., Detroit, Mich.
The Denver Rock Drill Mfg. Co., Denver, Colo.
Easton Car & Construction Co., Easton, Pa.—10
Erie Steam Shovel Co., Erie, Pa.—47
The Galion Iron Works & Mfg. Co., Galion, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
The Greenville Mfg. Works, Greenville, O.
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Harnischfeger Corp., Milwaukee, Wis.—Insert bet. 8-9
The Heltzel Steel Form & Iron Co., Warren, O.—65
Hubbard Steel Foundry Co., East Chicago, Ind.
Koehring Company, Milwaukee, Wis.—30-31
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Littleford Bros., Cincinnati, O.
Mackintosh-Hemphill Co., Pittsburgh, Pa.—290
Marion Steam Shovel Co., Marion, O.—26-27
McMyler-Interstate Co., Cleveland, O.—40
Northwest Engineering Works, Chicago, Ill.—Insert bet. 2-3
Orton Crane & Shovel Co., Chicago, Ill.—81
Pawling & Harnischfeger Co., Milwaukee, Wis. (Harnischfeger Corp.)—Insert bet. 8-9
Ross Power Equipment Co., Indianapolis, Ind.
Ruggles-Coles Eng. Co., New York, N. Y.
Sanford-Day Iron Works, Knoxville, Tenn.
Schofield-Burkett Construction Co., Macon, Pa.
Smith Eng. Wks., Milwaukee, Wis.—283
Dr. Bernhardi Sohn, Eilenburg, Germany
The Star Drilling Machine Co., Akron, O.—253
Sullivan Mchy. Co., Chicago, Ill.—87
The Sunbury Co., Sunbury, O.
Squier-Rix Co., Milwaukee, Wis.
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Universal Road Mchy. Co., Kingston, N. Y.—300
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.
Wehr Co., Milwaukee, Wis.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

ROCK DRILLS
(See Drills—Tripod, Hammer)

ROD MILLS
Jackson & Church Co., Saginaw, Mich.—257
Mine & Smelter Supply Co., New York, N. Y.—Inside back cover
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263

RODS (Welding)
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Oxweld Acetylene Co., New York, N. Y.—4

ROLLER BEARINGS
(See also Bearings)
Dodge Mfg. Co., Mishawaka, Ind.
Easton Car & Construction Co., Easton, Pa.—10
Hyatt Roller Bearing Co., Newark, N. J.—12-13
The New Departure Mfg. Co., Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Newark, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S. K. F. Co., New York, N. Y.
Timken Roller Bearing Co., Canton, O.—229

ROLLS ((Magnetic)
(See Magnetic Devices)

ROOFING AND SIDING MATERIAL
American Sheet & Tin Plate Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.—ingot iron—8
Bethlehem Steel Co., Bethlehem, Pa.
Continental Cement Tile Co., Chicago, Ill.
Federal Cement Tile Co., Chicago, Ill.
Illinois Zinc Co., Chicago, Ill.
Johns-Manville, Inc., New York, N. Y.—asbestos
The Komnick Machinery Co., Detroit, Mich.—278 and 301
Mullins Body Corp., Salem, O.
The New Jersey Zinc Co., New York, N. Y.—corrugated and flat zinc sheets
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
H. H. Robertson Co., Pittsburgh, Pa.
United Alloy Steel Corp., Canton, O.

ROPE (Manila)
Armstrong Mfg. Co., Waterloo, Ia.—55
H. W. Caldwell & Son Co., Chicago, Ill.—303
Colonial Supply Co., Pittsburgh, Pa.
Columbian Rope Co., Auburn, N. Y.
O. H. Davidson Equipment Co., Denver, Colo.
Filter Fabrics Co., Salt Lake City, Utah
The Hill Clutch Machine & Foundry Co., Cleveland, O.—transmission—302
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Hoover-Allison Co., Xenia, O.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.

ROPE (Manila)—Cont'd
Plymouth Cordage Co., New Plymouth, Mass.
The E. T. Rugg Co., Newark, O.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.

ROPE (Wire)
Cableway, Conveyor, Crane, Derrick, Dredge, Guy, Hoisting, Loading Machinery, Mining, Haulage, Steam Shovel
American Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—302
Armstrong Mfg. Co., Waterloo, Ia.—55
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Broderick & Bascom Rope Co., St. Louis, Mo.—46
H. W. Caldwell & Son Co., Chicago, Ill.—303
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Mfg. Corp., Mishawaka, Ind.
Hazard Mfg. Co., Wilkes-Barre, Pa.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Interstate Equipment Corporation, New York, N. Y.—ropeways—24
A. Leschen & Sons Rope Co., St. Louis, Mo.—Inside back cover
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
Pittsburgh Mining Mchy. Co., Pittsburgh, Pa.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—86

RUST PREVENTIVES
Dearborn Chemical Co., Chicago, Ill.
Detroit Graphite Co., Detroit, Mich.
Joseph Dixon Crucible Co., Jersey City, N. J.—303
North American Fibre Products Co., Cleveland, O.
Smooth-On Mfg. Co., Jersey City, N. J.

SAFETY DEVICES (Goggles, Respirators, etc.)
Barnard Machinery Co., Enterprise, Kan.
Chicago Eye Shield Co., Chicago, Ill.
Cleveland Railway Supply Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Electric Arc Cutting & Weld. Co., Newark, N. J.
Foamite-Childs Corp., Utica, N. Y.
The Linde Air Products Co., New York, N. Y.—goggles
Mine Safety Appliances Co., Pittsburgh, Pa.
Oxweld Acetylene Co., New York, N. Y.—goggles—4
The Prest-O-Lite Co., New York, N. Y.—goggles
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Pa.
Willson Goggles, Inc., Reading, Pa.

SAND AND GRAVEL HANDLING MACHINERY
American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
The C. O. Bartlett & Snow Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.—60
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
The Byers Mach. Co., Ravenna, O.—18
Chain Belt Co., Milwaukee, Wis.—96
The Dayton Whirley Co., Dayton, O.
The Galion Iron Works & Mfg. Co., Galion, O.
The Good Roads Machinery Co., Inc., Kennett Square, Pa.—61
The Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
McMyler-Interstate Co., Cleveland, O.—40
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Morris Machine Works, Baldwinsville, N. Y.
New Holland Mach. Co., New Holland, Pa.—283
Roberts & Schaefer Co., Chicago, Ill.—25
Sprout, Waldron & Co., Muncy, Pa.—298
Thaleg & Hock, Chicago, Ill.—33
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Universal Road Mach. Co., Kingston, N. Y.—300
Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

SAND AND GRAVEL WASHING PLANTS
(See Washers)

SAND GRINDING PANS
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Jackson & Church Co., Saginaw, Mich.—257
Kensington Steel Co., Chicago, Ill.—parts
Komnick Machy. Co., Detroit, Mich.—278 and 301
Lewistown Fdry. & Mach. Corp., Lewistown, Pa.—331

SAND GRINDING PANS—Cont'd

The Patterson Fdy. & Mach. Co., E. Liverpool, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Dr. Bernhardi Sohn, Eilenburg, Germany.
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263

SAND-LIME BRICK MACHINERY
(See Brick Machinery)

SAND-SEPARATING TANKS

Allen Cone Co., New York, N. Y.
W. H. K. Bennett, M. E., Chicago, Ill.
Greenville Mfg. Co., Greenville, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Morrow Mfg. Co., Columbus, O.
Smith Eng. Works, Milwaukee, Wis.—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
F. M. Welch Eng. Service, Greenville, O.—289

SAND SEPARATOR CONES

The Allen Cone Co., New York, N. Y.
W. H. K. Bennett, M. E., Chicago, Ill.
Colorado Iron Works Co., Denver, Colo.
Greenville Mfg. Co., Greenville, O.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
J. W. Paxson Co., Philadelphia, Pa.—50-51
Smith Eng. Works, Milwaukee, Wis.—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
United Iron Works, Inc., Joplin, Mo.
Webb City & Carterville Fdy. & Mach. Works, Webb City, Mo.

SAND SETTLING TANKS

Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Smith Eng. Wks., Milwaukee, Wis.—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
F. M. Welch Eng. Service, Greenville, O.—289

SAND STORAGE TANKS

Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Duff Patents Co., Inc., Pittsburgh, Pa.
Guarantee Construction Co., New York, N. Y.
Jackson & Church Co., Saginaw, Mich.—257
Littleford Bros., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
W. Toepfer & Sons Co., Milwaukee, Wis.—288
The Webster Mfg. Co., Chicago, Ill.

SCALES
(See also Weighing Equipment)

Automatic Weighing Mach. Co., New York, N. Y.
The Fairbanks Co., New York, N. Y.
E. and T. Fairbanks & Co., St. Johnsbury, Vt.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73
The Howe Scale Co., Rutland, Vt.
The Komnick Mchy. Co., Detroit, Mich—lime—278 and 301
Robert L. Latimer & Co., Philadelphia, Pa.
Merrick Scale Mfg. Co., Passaic, N. J.—296
Richardson Scale Co., Passaic, N. J.
Schaffer Poidometer Co. Pittsburgh Pa.—5
Standard Scale & Supply Corp., Pittsburgh, Pa.
Stearns Conveyor Co., Cleveland, O.
Strait Scale Co., Kansas City, Kan.
Sturtevant Mill Co., Boston, Mass.—85
Toledo Scale Co., Toledo, O.
Winslow Government Standard Scale Wks., Inc., Terre Haute, Ind.

SCRAPERS

American Manganese Steel Co., Chicago Hts., Ill.
The Austin-Western Road Machinery Co., Chicago, Ill.—dump and wheeled
Baker Mfg. Co., Springfield, Ill.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Burch Plow Works, Chestline, O.
W. H. Dance, Cambridge, Mass.
The Galion Iron Wks. & Mfg. Co., Galion, O.
Good Roads Mchy. Co., Kennett Square, Pa.—61
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Manning, Maxwell & Moore, Inc., New York, N. Y.
Miami Trailer Scraper Co., Troy, O.
Northwest Engineering Co., Chicago, Ill.—Insert bet. 2-3
Sauerman Bros., Chicago, Ill.—256
Scofield-Burkett Construction Co., Macon, Ga.
The Sunbury Mfg. Co., Sunbury, O.
Thaleg & Hock, Chicago, Ill.—33
Thomas Elevator Co., Chicago, Ill.
Wehr Co., Milwaukee, Wis.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

SCREEN NOZZLES

American Manganese Steel Co., Chicago Hts., Ill.
Pettibone-Mulliken Co., Chicago, Ill.
Swintek Traveling Suction Screen Co., Eddyville, Ia.

SCREENS

Acme Road Mchy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Audubon Wire Cloth Co., Inc., Audubon, N. J.
Austin Manufacturing Co., Chicago, Ill.—36
Austin-Western Road Machinery Co., Chicago, Ill.
Earle C. Bacon, Inc., New York, N. Y.—275
C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Besser Sales Co., Chicago, Ill.
C. G. Buchanan Co., Inc., New York, N. Y.—34-35
Buffalo Wire Works, Buffalo, N. Y.
H. W. Caldwell & Son Co., Chicago, Ill.—303
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Chicago Perforating Co., Chicago, Ill.—304
The Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—289
Colorado Iron Works, Denver, Colo.
The Columbus Conveyor Co., Columbus, O.—255
A. D. Cook, Inc., Lawrenceburg, Ind.
Coyle & Roth, Minneapolis, Minn.
Cross Engineering Co., Carbondale, Pa.—273
W. H. Dance, Cambridge, Mass.
The Deister Concentrator Co., Fort Wayne, Ind. —299
Dodge Mfg. Co., Mishawaka, Ind.
Dixie Machy. Mfg. Co., St. Louis, Mo.—3
Eagle Iron Works, Des Moines, Ia.—305
Ebersol Eng. Co., Blue Hill, Lancaster Co., Pa.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan. —301
Exeter Machine Works, Inc., West Pittston, Pa.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Galion Iron Works, Galion, O.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Rubert M. Gay Co., Inc., New York, N. Y.—303
Gehret Bros., Bridgeport, Pa.
Good Roads Mchy. Co., Inc., Kennett Square, Pa.—61
Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—245
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Geo. Haiss Mfg. Co., New York, N. Y.
Hardinge Co., New York, N. Y.—66-67
Harrington & King Perf. Co., Chicago, Ill.—300
W. P. Heineken, Eng'r, New York, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.—306
Joshua Hendy Iron Works, San Francisco, Calif.
Hesse-Ersted Iron Works, Portland, Ore.
S. Howes Co., Silver Creek, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.—41
The Jeffrey Mfg. Co., Columbus, O.—58-59
Johnston & Chapman Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York City, N. Y.
Kent Mill Co., Brooklyn, N. Y.—276
The Komnick Machy. Co., Detroit, Mich.—278 and 301
Lewistown Foundry & Machine Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.—Insert bet. 264-265
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—all kinds—272
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
The Morrow Mfg. Co., Columbus, O.
Newark Wire-Cloth Co., Newark, N. J.
New Holland Mach. Co., New Holland, Pa.—283
Nortmann-Duffke Co., Milwaukee, Wis.
The Orville Simpson Co., Cincinnati, O.—1
Pioneer Tractors, Inc., Winona, Minn.
Robins Conveying Belt Co., New York, N. Y.—249
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ross Power Equipment Co., Indianapolis, Ind.
James B. Seaverns Co., Chicago, Ill.
Roberts & Schaefer Co., Chicago, Ill.—25
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Smith Eng. Wks., Milwaukee, Wis.—283
The Stearns Conveyor Co., Cleveland, O.
Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Stevenson Co., Wellsville, O.
E. H. Stroud & Co., Chicago, Ill.—305
Sturtevant-Mill Co., Boston, Mass.—85
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Thaleg & Hock, Chicago, Ill.—33

SCREENS—Cont'd

Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
The W. S. Tyler Co., Cleveland, O.
The Union Engineering Co., Cleveland, O.
Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Inc., Joplin, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—276
Universal Road Mchy. Co., Kingston, N. Y.—300
Universal Vibrating Screen Co., Racine, Wis.—9
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233
Wickwire Spencer Steel Co., New York, N. Y.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

SCREENS (Shaking)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
The C. O. Bartlett & Snow Co., Cleveland, O.
The Brown Hoisting Machinery Co., Cleveland, O.—280
H. W. Caldwell & Son, Chicago, Ill.—303
Egyptian Iron Works, Murphysboro, Ill.
Good Roads Machy. Co., Kennett Square, Pa.—61
The Harrington & King Perforating Co., Chicago, Ill.—300
Hendrick Mfg. Co., Carbondale, Pa.—306
Jeffrey Mfg. Co., Columbus, O.—58-59
Kennedy-Van Saun Mfg. & Eng. Co., New York, N. Y.
Komnick Machy. Co., Detroit, Mich.—278 and 301
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Roberts & Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
Simplex Screen Co., Salt Lake City, Utah
The Orville Simpson Co., Cincinnati, O.—1
Sprout, Waldron & Co., Muncy, Pa.—298
Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Traylor Engineering & Mfg. Co., Allentown, Pa. —262-263
Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Joplin, Mo.
Universal Vibrating Screen Co., Racine, Wis.—9
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—Insert bet. 4-5

SCREENS (Vibrating)

American Manganese Steel Co., Chicago Hts., Ill.
R. H. Beaumont Co., Philadelphia, Pa.
Colorado Iron Works Co., Denver, Colo.
The Deister Concentrator Co., Fort Wayne, Ind. —299
Galland-Henning Mfg. Co., Milwaukee, Wis.
Rubert M. Gay Co., Inc., New York, N. Y.—303
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
National Engineering Co., Chicago, Ill.
Orville Simpson Co., Cincinnati, O.—1
Roberts & Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
Simplicity Engineering Co., Durand, Mich.—287
Simpson Co., The Orville, Cincinnati, O.—1
Southwest Eng. Co., Los Angeles, Calif.
Stedman's Fdry. & Mach. Wks., Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.—85
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Traylor Vibrator Co., Denver, Colo.—Insert bet. 272-273
W. S. Tyler, Cleveland, O.
Universal Vibrating Screen Co., Racine, Wis.—9

SCREW CONVEYORS

H. W. Caldwell & Son Co., Chicago, Ill.—303
The Webster Mfg. Co., Chicago, Ill.

SEPARATORS
(See Air Separators and Magnetic Separators

SEPARATORS (Sand)
(See Sand Separator Tanks)

SHAFT HANGERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Pulley Co., Philadelphia, Pa.
Anchor Concrete Machy. Co., Adrian, Mich.—277
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
The Hanson Clutch & Mchy. Co., Tiffin, O.
Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302
Jeffrey Mfg. Co., Columbus, O.—58-59
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Palmer-Bee Co., Detroit, Mich.—6
A. Plamondon Mfg. Co., Chicago, Ill.
Robinson Mfg. Co., Muncy, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298
Union Chain & Mfg. Co., Sandusky, O.
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
T. B. Wood's Sons Co., Chambersburg, Pa.—233

SHARPENING MACHINES (Drill)
(See Drill Sharpening Machines)

SHEAVES

Allis-Chalmers Mfg. Co., Milwaukee,Wis.—225
American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
American Steel & Wire Co., Chicago, Ill.—302
Baker Car Co., Harriman, Tenn.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.
Bedford Fdry. & Mach. Co., Bedford, Ind.
H. W. Caldwell & Son Co., Chicago, Ill.—303
C. S. Card Iron Works Co., Denver, Colo.
Clyde Iron Works, Duluth, Minn.
The Columbus Conveyor Co., Columbus, O.—255
Conveyors Corp. of America, Chicago, Ill.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Dodge Mfg. Co., Mishawaka, Ind.
The J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—301
Farrell-Cheek Steel Fdry. Co., Sandusky, O.—244
Galland-Henning Mfg. Co., Milwaukee, Wis.
Godfrey Conveyor Co., Elkhart, Ind.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Hart Sheave Co., Martinsville, Ind.—304
Joshua Hendy Iron Works, San Francisco, Calif.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Hockensmith Wheel & Mine Car Co., Penn, Pa.
John T. Horton Co., Inc., New York, N. Y.
Indiana Foundry Co., Inc., Indiana, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Kensington Steel Co., Chicago, Ill.
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
Medart Co., St. Louis, Mo.
The Mining Machine Co., Mountville, Pa.
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Morgan Eng. Co., Alliance, O.
Newhall Chain Forge & Iron Co., New York, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.—297
Ottumwa Iron Works, Ottumwa, Ia.
Pettibone-Mulliken Co., Chicago, Ill.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Sanford-Day Iron Works, Knoxville, Tenn.
Scofield-Burkett Construction Co., Macon, Ga.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
United Iron Works, Inc., Joplin, Mo.
Upson-Walton Co., Cleveland, O.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
Wellman-Seaver-Morgan Co., Cleveland, O.
Williamsport Wire Rope Co., Williamsport, Pa.—86
T. B. Wood's Sons Co., Chambersburg, Pa.—233

SHIELDS (Eye, Face, Body)

Chicago Eye Shield Co., Chicago, Ill.
Electric Arc Cutting & Welding Co., Newark, N. J.
The Kirk & Blum Mfg. Co., Cincinnati, O.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Pa.

SHOVELS (Diesel or Oil)
(See Power Shovels)

SHOVELS (Hand)

Conneaut Shovel Co., Conneaut, O.—266
The Wood Shovel & Tool Co., Piqua, O.—279
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS (Power)
(See Power Shovels)

SHOVEL (Power) REPAIR PARTS

American Manganese Steel Co., Chicago Hts., Ill.
Bucyrus Co., South Milwaukee, Wis.—Insert bet. 232-233
Electric Manganese Steel Co., Reading, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Kensington Steel Co., Chicago, Ill.
Moore & Moore, Inc., Reading, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Stroh Steel Hardening Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

SILOS

Burrell Eng. & Constr. Co., Chicago, Ill.—295
Macdonald Engineering Co., Chicago, Ill.—298
F. L. Smidth & Co., New York, N. Y.—69-70-71

SKIPS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car & Fdry. Co., New York, N. Y.
American Hoist & Derrick Co., St. Paul, Minn.—298
Atlas Car & Mfg. Co., Cleveland, O.—260
Earle C. Bacon, Inc., New York, N. Y.—275
C. O. Bartlett & Snow Co., Cleveland, O.
R. H. Beaumont Co., Philadelphia, Pa.
Bedford Fdry. & Mach. Co., Bedford, Ind.
The Biehl Iron Works, Inc., Reading, Pa.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—96
Clyde Iron Works, Duluth, Minn.
Easton Car & Construction Co., Easton, Pa.—10
The Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Construction Co., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
Wilbur G. Hudson Corp., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.—58-59
Koppel Industrial Car & Equipment Co., Koppel, Pa.—284
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.
Manitowoc Eng. Works, Manitowoc, Wis.—293
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Foundry & Mfg. Co., Reading, Pa.
Roberts & Schaefer Co., Chicago, Ill.—25
Robins Conveying Belt Co., New York, N. Y.—249
Stearns-Rogers Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
United Iron Works, Inc., Joplin, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237
The Wellman-Seaver-Morgan Co., Cleveland, O.

SLATE WORKING MACHINERY

S. Flory Mfg. Co., Bangor, Pa.—304
The Komnick Machinery Co., Detroit, Mich.—278 and 301
Ruggles Machine Co., Poultney, Vt.
Sullivan Machinery Co., Chicago, Ill.—87
Dr. Bernhardi Sohn, Eilenburg, Germany.

SLINGS

American Cable Co., Inc., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—302
A. Leschen & Sons Rope Co., St. Louis, Mo.—Inside back cover
John A. Roebling's Sons Co., Trenton, N. J.—wire rope—Insert bet. 232-233
Woodhouse Chain Works, Trenton, N. J.—267

SPECIFIC GRAVITY APPARATUS
(For Cement)

Central Scientific Co., Chicago, Ill.
E. H. Sargent & Co., Chicago, Ill.

SPEED REDUCERS

Albaugh-Dover Mfg. Co., Chicago, Ill.
Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—303
Chain Belt Co., Milwaukee, Wis.—96
The Cleveland Worm & Gear Co., Cleveland, O.—82-83
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49
De Laval Steam Turbine Co., Trenton, N. J.—63
Dodge Mfg. Co., Mishawaka, Ind.
Falk Corp., Milwaukee, Wis.—Insert bet. 232-233
Farrell Foundry & Machine Co., Buffalo, N. Y.
Fawcus Mach. Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., Chicago, Ill.
Wm. Ganschow Co., Chicago, Ill.—287
Hill Clutch Machine & Foundry Co., Cleveland, O.—302
Horsburgh & Scott Co., Cleveland, O.—286
D. O. James Mfg. Co., Chicago, Ill.—14-15

SPEED REDUCERS—Cont'd

W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Lewis Fdry. & Mach. Co., Pittsburgh, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
W. C. Lipe, Inc., Syracuse, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
R. D. Nuttall Co., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.—6
Philadelphia Gear Works, Philadelphia, Pa.—265
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Eng. & Machine Co., Baltimore, Md.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
The Terry Steam Turbine Co., Hartford, Conn.
Twin Disc Clutch Co., Racine, Wis.—Insert bet. 2-3
Watson-Flagg Eng. Co., Paterson, N. J.—278
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
T. B. Wood's Sons Co., Chambersburg, Pa.—233

SPOUTS, CHUTES
(See Chutes and Chute Liners)

SPOUTS (Magnetic)
(See Magnetic Devices)

SPROCKETS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Car and Fdy. Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—303
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—96
The Columbus Conveyor Co., Columbus, O.—255
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Farrell-Cheek Steel Fdy. Co., Sandusky, O.—244
Foote Bros. Gear & Machine Co., Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Galland-Henning Mfg. Co., Milwaukee, Wis.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Mach. & Fdry. Co., Cleveland, O.—302
Horsburgh & Scott Co., Cleveland, O.—286
Howe Chain Co., Muskegon, Mich.
The Jeffrey Mfg. Co., Columbus, O.—58-59
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Kensington Steel Co., Chicago, Ill.
Robert L. Latimer & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Montgomery Coal Washing & Mfg. Co., Birmingham, Ala.
Morse Chain Co., Ithaca, N. Y.—62
R. D. Nuttall Co., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.—6
Pettibone-Mulliken Co., Chicago, Ill.
Philadelphia Gear Works, Philadelphia, Pa.—265
Robins Conveying Belt Co., New York, N. Y.—249
Robinson Mfg. Co., Muncy, Pa.
Sprout, Waldron & Co., Muncy, Pa.—298
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
S. G. Taylor Chain Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Ill.—33
Union Chain & Mfg. Co., Sandusky, O.
United Iron Works, Inc., Joplin, Mo.
Watson-Flagg Eng. Co., Paterson, N. J.—278
The Webster Mfg. Co., Chicago, Ill.
The Weller Mfg. Co., Chicago, Ill.—237
The Whitney Mfg. Co., Hartford, Conn.

STACKS

Bedford Fdy. & Mach. Co., Bedford, Ind.
The Biggs Boiler Works Co., Akron, O.
Brownell Co., Dayton, O.
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Davenport Locomotive Works, Davenport, Ia.
Duff Patents Co., Inc., Pittsburgh, Pa.—steel
Galland-Henning Mfg. Co., Milwaukee, Wis.
Heil Co., Milwaukee, Wis.
Heine Boiler Co., St. Louis, Mo.
The Heltzel Steel Form & Iron Co., Warren, O.—steel—65
Hendrick Mfg. Co., Carbondale, Pa.—306
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Jackson & Church Co., Saginaw, Mich.—257
E. Keeler Co., Williamsport, Pa.
Komnick Machy. Co., Detroit, Mich.—278-301
Littleford Bros., Cincinnati, O.

STACKS—Cont'd

Macdonald Engineering Co., Chicago, Ill.—concrete—298
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
H. Miscampbell, Duluth, Minn.—dust collecting—246-247
Naylor Spiral Pipe Co., Chicago, Ill.—241
J. W. Paxson Co., Philadelphia, Pa.—50-51
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.
Ross Power Equipment Co., Indianapolis, Ind.
J. S. Schofield's Sons Co., Macon, Ga.
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

STARTERS (Electric Motor)

Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

STEAM ENGINES
(See Engines)

STEAM SHOVELS
(See Power Shovels)

STEEL

Bollinger-Andrews Construction Co., Pittsburgh, Pa.—304
Chrome Steel Works, Carteret, N. J.—74
The Farrell-Cheek Steel Fdy. Co., Sandusky, O.—244
Ludlum Steel Co., Watervliet, N. Y.—305
Manganese Steel Forge Co., Philadelphia, Pa.—76-77

STEEL (Sheet)

American Rolling Mill Co., Middletown, O.—8
American Sheet & Tinplate Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Tuscon Steel Co., Youngstown, O.
United Alloy Steel Co., Canton, O.

STEEL (Special Alloy)
(See also Manganese Steel)

Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Haynes Stellite Co., New York, N. Y.
Kensington Steel Co., Chicago, Ill.
Ludlum Steel Company, Watervliet, N. Y.—305

STEEL FABRICATION
(See Structural Steel Work)

STEEL PLATE CONSTRUCTION

American Car and Fdy. Co., New York, N. Y.
Bollinger-Andrews Construction Co., Pittsburgh, Pa.—304
The Heltzel Steel Form & Iron Co., Warren, O.—65
Hendrick Mfg. Co., Carbondale, Pa.—306
Jackson & Church Co., Saginaw, Mich.—257
Littleford Bros., Cincinnati, O.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
McGann Mfg. Company, Inc., York, Pa.—254
Minneapolis Steel & Machy. Co., Minneapolis, Minn.

STELLITE

Haynes Stellite Co., New York, N. Y.

STOKERS

Arnold & Weigel, Woodville, O.—lime klin—250-251
Illinois Stoker Co., Alton, Ill.—chain grate
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—38-39
Riley Stoker Corp., Worcester, Mass.—mechanical
Schaffer Eng. Co., Pittsburgh, Pa.—lime kiln
E. H. Stroud & Co., Chicago, Ill.—305

STONE GRAPPLES
(See Grapples)

STORAGE (Cement Silo)

Bland Eng. Co., Minneapolis, Minn.
Burrell Eng. & Const. Co., Chicago, Ill.—295
Guarantee Construction Co., New York, N. Y.
Macdonald Engineering Co., Chicago, Ill.—cement and slurry—298
Manitowoc Engineering Works, Manitowoc, Wis.—steel—293
F. L. Smidth & Co., New York, N. Y.—69-70-71
The Spencer Construction Co., Baltimore, Md. (Eastern Branch Macdonald Eng. Co.)

STORAGE SYSTEMS (Oil and Gas)

S. F. Bowser & Co., Ft. Wayne, Ind.
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Columbian Steel Tank Co., Kansas City, Mo.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

STRUCTURAL STEEL WORK

American Bridge Co., Chicago, Ill.
American Car & Fdy. Co., New York, N. Y.
The Austin Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bedford Fdy. & Mchy. Co., Bedford, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Bollinger-Andrews Construction Co., Pittsburgh, Pa.—304
Blaw-Knox Co., Pittsburgh, Pa.—60

STRUCTURAL STEEL WORK—Cont'd

Exeter Machine Works, Inc., West Pittston, Pa.
H. K. Ferguson Co., Cleveland, O.—232
Gehret Bros., Inc., Bridgeport, Pa.
The Heltzel Steel Form & Iron Co., Warren, O.—65
Insley Mfg. Co., Indianapolis, Ind.
Jackson & Church Co., Saginaw, Mich.—257
The Kirk & Blum Mfg. Co., Cincinnati, O.
Robert L. Latimer & Co., Philadelphia, Pa.
Littleford Bros., Cincinnati, O.
The McMyler-Interstate Co., Cleveland, O.—40
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Minneapolis Steel & Machy. Co., Minneapolis, Minn.
The Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Penn Bridge Co., Beaver Falls, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Wks., Joplin, Mo.
The Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237
The Wellman-Seaver-Morgan Co., Cleveland, O.

STUCCO FACINGS

Crown Point Spar Co., Inc., New York, N. Y.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.
Middlebury Marble Co., Brandon, Vt.
Vermont Milling Products Corp., Poultney, Vt.

SUPERHEATERS

Babcock & Wilcox Co., New York, N. Y.
Power Specialty Co., New York, N. Y.
The Superheater Co., New York, N. Y.

SWITCHES (Electrical)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
The Atlas Car & Mfg. Co., Cleveland, O.—260
The Automatic Reclosing Circuit Breaker Co., Columbus, O.
The Chase Fdry. & Mfg. Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—49
The Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
The Johns-Pratt Co., Hartford, Conn.
Ohio Brass Co., Mansfield, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

SWITCHES (Track)
(See Frogs and Switches)

TANKS

Allen Cone Co., New York, N. Y.—dewatering, sand washing, thickening, etc.
American Car and Fdy. Co., New York, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Bethlehem Ship Building Corp., Bethlehem, Pa.
Bland Eng. Co., Minneapolis, Minn.—concrete
Blaw-Knox Co., Pittsburgh, Pa.—60
The Biggs Boiler Works Co., Akron, O.
S. F. Blower Co., Inc., Ft. Wayne, Ind.—gasoline and oil
The Brownell Co., Dayton, O.
W. E. Caldwell Co., Louisville, Ky.—wood, steel and galvanized
Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Chicago Bridge & Iron Works, Chicago, Ill.
Coatesville Boiler Works, Coatesville, Pa.
Columbian Steel Tank Co., Kansas City, Mo.
Conveyors Corp. of America, Chicago, Ill.
Davenport Locomotive Works, Davenport, Ia.
J. P. Devine Co., Buffalo, N. Y.
The Dorr Co., New York, N. Y.—56
Duff Patents Co., Inc., Pittsburgh, Pa.—steel
Erie City Iron Works, Erie, Pa.
Galland-Henning Mfg. Co., Milwaukee, Wis.
Gehret Bros., Bridgeport, Pa.
Gilbert & Barker Mfg. Co., Springfield, Mass.
The Heil Co., Milwaukee, Wis.
Heine Boiler Co., St. Louis, Mo.—special construction
Hendrick Mfg. Co., Carbondale, Pa.—306
Jackson & Church Co., Saginaw, Mich.—257
The Kirk & Blum Mfg. Co., Cincinnati, O.
Link-Belt Company, Chicago, Ill.—Back cover and 42-43
Littleford Bros., Cincinnati, O.—steel
Manitowoc Eng. Wks., Manitowoc, Wis.—steel—293
McGann Mfg. Co., Inc., York, Pa.—254
H. Miscampbell, Duluth, Minn.—lime—246-247
Murray Iron Works Co., Burlington, Ia.
The Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Petroleum Iron Works Co. of Ohio, Sharon, Pa.—water
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.
Smith Eng. Wks., Milwaukee, Wis.—283
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Stearns-Rogers Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
Sturtevant Mill Co., Boston, Mass.—85
The Sykes Co., Chicago, Ill.
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263

TANKS—Cont'd

United Iron Wks., Inc., Joplin, Mo.
United Lead Co., New York, N. Y.
Walsh & Widner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.—storage tanks
The Weber Chimney Co., Chicago, Ill.
Weller Mfg. Co., Chicagoo, Ill.—237
Worthington Pump & Machy. Corp., New York, N. Y.—air and compressor; pneumatic water supply
Youngstown Boiler & Tank Co., Youngstown, O.

TANKS (Pressure)

Chattanooga Boiler & Tank Co., Chattanooga, Tenn.
Columbian Steel Tank Co., Kansas City, Mo.
Heil Co., Milwaukee, Wis.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
Murray Iron Works Co., Burlington, Ia.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263

TARPAULINS

The Allied Belting Co., Greenville, O.
Cleveland-Akron Bag Co., Cleveland, O.
Hettrick Mfg. Co., Toledo, O.
Upson-Walton Co., Cleveland, O.
The M. I. Wilcox Co., Toledo, O.

TEETH (Dipper)
(See Dipper Teeth)

TESTING MACHINERY

Braun Corp., Los Angeles, Calif.
Central Scientific Co., Chicago, Ill.
Eimer & Amend, New York, N. Y.
The Precision Scientific Co., Chicago, Ill.
Riehle Bros. Testing Mach. Co., Philadelphia, Pa.
E. H. Sargent & Co., Chicago, Ill.
Thwing Instrument Co., Philadlephia, Pa.
Tinius Olsen Testing Mach. Co., Philadelphia, Pa.
Will Corporation, Rochester, N. Y.

TESTING LABORATORIES

Arnold & Weigel, Woodville, O.—250-251
Geo. Borrowman, Ph. D., Chicago, Ill.
Central Scientific Co., Chicago, Ill.
The Denver Fire Clay Co., Denver, Colo.
The Dorr Co., New York, N. Y.—56
Robt. W. Hunt & Co., Chicago, Ill.—305
H. Miscampbell, Duluth, Minn.—246-247
Pittsburgh Testing Laboratories, Pittsburgh, Pa.
H. Wiedeman, Chemist, St. Louis, Mo.

TESTING SIEVES AND SHAKERS

Hendrick Mfg. Co., Carbondale, Pa.—306
Newark Wire Cloth Co., Newark, N. J.
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—85
The W. S. Tyler Co., Cleveland, O.
Will Corporation, Rochester, N. Y.

THERMOMETERS
(See Pyrometers)

THICKENERS
(See Agitators)

TIGHTENERS (Automatic)

H. W. Caldwell & Son Co., Chicago, Ill.—303
Hill Clutch Machinery & Foundry Co., Cleveland, O.—302
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried, San Francisco, Calif.
F. L. Smidth Co., New York, N. Y.—69-70-71
Sprout, Waldron & Co., Muncy, Pa.—298
T. B. Wood's Sons Co., Chambersburg, Pa.—233

TILE MACHINERY

Anchor Concrete Mchy. Co., Adrian, Mich.—277
Besser Sales Co., Chicago, Ill.—concrete
Buttress Plaster Board Machinery Co., Los Angeles, Calif.—gypsum
Concrete Equip. Co., Holland, Mich.
W. E. Dunn Mfg. Co., Holland, Mich.—concrete
Helm Brick Machine Co., Cadillac, Mich.—concrete building tile
A. J. Heskett Concrete Machy. Co., Williamsport, Pa.—68
Ideal Concrete Machy. Co., Cincinnati, O.—239
Kensington Steel Co., Chicago, Ill.—parts
National Stone-Tile Corp., San Francisco, Calif.
Shope Brick Co., Portland, Ore.—concrete floor
Supertile Machinery Corp., Tecumseh, Mich.

TIRES (For Tractors, Trucks and Industrial Trucks)

The Goodyear Tire & Rubber Co., Inc., Akron, O.
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
U. S. Rubber Co., New York, N. Y.—231

TOOL STEEL

Bethlehem Steel Co., Bethlehem, Pa.
Colonial Steel Co., Pittsburgh, Pa.—281
Haynes Stellite Co., New York, N. Y.
Ludlum Steel Co., Watervliet, N. Y.—305
The Midvale Co., Philadelphia, Pa.—54
Joseph T. Ryerson & Son, Inc., Chicago, Ill.

TOOLS, DRILL
(See Drilling Accessories)

TRACK EQUIPMENT

Aldon Co., Chicago, Ill.
American Frog & Switch Co., Hamilton, O.
American Manganese Steel Co., Chicago Hts., Ill.
Atlas Car & Mfg. Co., Cleveland, O.—260
Bethlehem Steel Co., Bethlehem, Pa.
The Biehl Iron Works, Inc., Reading, Pa.
The Buda Co., Harvey, Ill.
C. S. Card Iron Works, Denver, Colo.
Central Frog & Switch Co., Cincinnati, O.—302
The Chase Fdry. & Mfg. Co., Columbus, O.
Cincinnati Frog & Switch Co., Cincinnati, O.
The Cleveland Railway Supply Co., Cleveland, O.
Co-operative Utilities Co., Philadelphia, Pa.
Easton Car & Construction Co., Easton, Pa.—10
T. H. Edelblute Co., Pittsburgh, Pa.—301
Elliott Frog & Switch Co., East St. Louis, Ill.
Engineering Products Co., Chicago, Ill.
Fairmont Mining Mach. Co., Fairmont, W. Va.
L. B. Foster Co., Pittsburgh, Pa.—88
M. K. Frank, Pittsburgh, Pa.
Frog, Switch & Mfg. Co., Carlisle, Pa.
The Full-Crawler Co., Milwaukee, Wis.
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
The Hyde & Co., Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.
International Clay Machinery Co., Dayton, O.
Kensington Steel Co., Chicago, Ill.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—284
Lakewood Eng. Co., Cleveland, O.
Maris Bros., Philadelphia, Pa.
Morrison & Risman Co., Inc., Buffalo, N. Y.
Ohio Brass Co., Mansfield, O.
Palmer-Bee Co., Detroit, Mich.—6
Pettibone-Mulliken Co., Chicago, Ill.
Sweet's Steel Co., Williamsport, Pa.—290
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
United Iron Works, Inc., Joplin, Mo.
Weir Frog Co., Cincinnati, O.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233

TRACK SHIFTERS

Clyde Iron Works, Duluth, Minn.
Nordberg Mfg. Co., Milwaukee, Wis.—297

TRACTORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Atlas Car & Mfg. Co., Cleveland, O.—260
The Autocar Co., Ardmore, Pa.—truck
Bates Machine & Tractor Co., Joliet, Ill.
Brookville Loco. Co., Brookville, Pa.—270
Caterpillar Tractor Co., San Leandro, Calif.
Clark Tructractor Co., Chicago, Ill.—dump
Continental Motors Corp., Detroit, Mich.
Diamond T Motor Car Co., Chicago, Ill.—truck
Easton Car & Construction Co., Easton, Pa.—10
Elwell-Parker Electric Co., Cleveland, O.
Ford Motor Co., Detroit, Mich.
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Huber Mfg. Co., Marion, O.
J. T. Tractor Co., Cleveland, O.
Kansas City Hay Press Co., Kansas City, Mo.—304
Kensington Steel Co., Chicago, Ill.—parts
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
The Lakewood Eng. Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.—75
Miami Trailer Scraper Co., Troy, O.
Minneapolis Steel & Mchy. Co., Minneapolis, Minn.
Pioneer Tractors, Inc., Winona, Minn.
Sterling Motor Truck Co., Milwaukee, Wis.
Thaleg & Hock, Chicago, Ill.—33
Traylor Eng. & Mfg. Co., Allentown, Pa.—262-263
Yale & Towne Mfg. Co., Stamford, Conn.—electric

TRAILERS

Easton Car & Const. Co., Easton, Pa.—10
The Fairbanks Co., New York, N. Y.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—284
The Lakewood Eng. Co., Cleveland, O.—industrial
Miami Trailer Scraper Co., Troy, O.
The Troy Trailer & Wagon Co., Troy, O.
Yale & Towne Mfg. Co., Stamford, Conn.

TRAMWAYS

(See Aerial Tramways)

TRANSFORMERS

(See Electric Motors)

TRANSMISSION BELTING

(See Belting)

TRANSMISSION MACHINERY AND EQUIPMENT

(See Power Tranmission Machinery)

TROLLEYS (Single I-Beam)

H. D. Conkey & Co., Mendota, Ill.
Curtis Pneumatic Mchy. Co., St. Louis, Mo.
The Hill Clutch Mach. & Fdy. Co., Cleveland, O.—302

TROLLEYS—Cont'd

Maris Bros., Inc., Philadelphia, Pa.—overhead
Northern Eng. Wks., Detroit, Mich.—298
Palmer-Bee Co., Detroit, Mich.—6
Roeper Crane & Hoist Works, Inc., Reading, Pa.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Geo. D. Whitcomb Co., Rochelle, Ill.—305
Wright Mfg. Co., Libson, O.—296
Yale & Towne Mfg. Co., Stamford, Conn.

TRUCK BODIES (Commercial Car)

Acme Motor Truck Co., Cadillac, Mich.
American Car & Foundry Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—260
Columbian Steel Tank Co., Kansas City, Mo.
Ditwiler Mfg. Co., Galion, O.—277
Easton Car & Const. Co., Easton, Pa.—10
Enterprise Wheel & Car Corp., Bristol, Tenn.—industrial
Greenville Mfg. Wks., Greenville, O.
The Heil Co., Milwaukee, Wis.—gravity, mechanical, and hydraulic
The Hug Co., Highland, Ill.
The Hughes-Keenan Co., Mansfield, O.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
International Motor Co., New York, N. Y.—steel dumping
Lee Trailer & Body Co., Chicago, Ill.—dump for motor trucks
Littleford Bros., Cincinnati, O.—steel
Mullins Body Corp., Salem, O.
Penn Foundry & Mfg. Co., Reading, Pa.
Reeves Bros. Co., Alliance, O.
Standard Steel Works, North Kansas City, Mo.—dump
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
U. S. Motor Truck Co., Cincinnati, O.
Wood Hydraulic Hoist & Body Co., Detroit, Mich.

TRUCK CRANES

(See Cranes)

TRUCKS (Electrical and Industrial)

Elwell-Parker Electric Co., Cleveland, O.
Enterprise Wheel & Car Corp., Bristol, Tenn.—roller bearing
The Fairbanks Company, New York, N. Y.—industrial
The Lakewood Eng. Co., Cleveland, O.
Western Wheeled Scraper Co., Aurora, Ill.—Insert bet. 232-233
Yale & Towne Mfg. Co., Stamford, Conn.

TRUCK LOADERS

(See Loaders)

TUBE MILL LINERS

(See Mill Liners and Linings)

TUBE MILLS

(See Mills, Ball, Tube, etc.)

TUNNELING MACHINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
Erie Steam Shovel Co., Erie, Pa.—47
Hoar Shovel Co., Duluth, Minn.
Jeffrey Mfg. Co., Columbus, O.—58-59
Myers-Whaley Co., Knoxville, Tenn.
Nordberg Mfg. Co., Milwaukee, Wis.—297
The Osgood Co., Marion, O.—301
The Thew Shovel Co., Lorain, O.—Insert bet. 80-81

TURBINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—steam and hydraulic—225
Buffalo Forge Co., Buffalo, N. Y.
De Laval Steam Turbine Co., Trenton, N. J.—steam, hydraulic—63
The Elliott Co., Wellsville, N. Y.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Moore Steam Turbine Corp., Wellsville, N. Y.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Ross Power Equipment Co., Indianapolis, Ind.
B. F. Sturtevant Co., Boston, Mass.
The Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

TURNTABLES

Atlas Car & Mfg. Co., Cleveland, O.—260
Bethlehem Steel Co., Bethlehem, Pa.
The Chase Fdry. & Construction Co., Easton, Pa.
Easton Car & Const. Co., Easton, Pa.—10
The Hug Co., Highland, Ill.—motor truck
C. W. Hunt Co., Staten Island, N. Y.
Jackson & Church Co., Saginaw, Mich.—257
Komnick Machy. Co., Detroit, Mich.—278 and 301
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Lakewood Eng. Co., Cleveland, O.
McMyler-Interstate Co., Cleveland, O.—40
Northern Eng. Wks., Detroit, Mich.—298
Palmer-Bee Co., Detroit, Mich.—6
Dr. Bernhardi Sohn, Eilenburg, Germany
Steacy-Schmidt Mfg. Co., York, Pa.

UNDERGROUND LOADERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—225
American Manganese Steel Co., Chicago Hts., Ill.
Erie Steam Shovel Co., Erie, Pa.—47
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hoar Shovel Co., Duluth, Minn.
Jeffrey Mfg. Co., Columbus, O.—58-59
Kensington Steel Co., Chicago, Ill.—parts
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Myers-Whaley Co., Knoxville, Tenn.
Nordberg Mfg. Co., Milwaukee, Wis.—297
The Osgood Co., Marion, O.—301
Thew Shovel Co., Lorain, O.—Insert bet. 80-81

UNLOADERS

(See Loaders, Unloaders)

VALVES

American Car and Fdy. Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Bay City Foundry & Machine Co., Bay City, Mich.
A. W. Cadman Mfg. Co., Pittsburgh, Pa.—84
Cleveland Rock Drill Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
G. M. Davis Regulator Co., Chicago, Ill.
Diamond Rubber Co., Akron, O.—pump, rubber
R. & J. Dick Co., Inc., Passaic, N. J.
Dixon Valve & Coupling Co., Philadelphia, Pa.
The Emerson Pump & Valve Co., Alexandria, Va.
The Fairbanks Co., New York, N. Y.
Fairbanks-Morse & Co., Chicago, Ill.—Insert bet. 72-73
B. F. Goodrich Rubber Co., Akron, O.—Insert bet. 4-5
Haynes Stellite Co., New York, N. Y.
Jenkins Bros., New York, N. Y.
Kelly & Jones Co., Greensburg, Pa.
Knox Mfg. Co., Philadelphia, Pa.—steam
The Linde Air Products Co., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.—299
Manning, Maxwell & Moore, Inc., New York, N. Y.
Merco-Nordstrom Valve Co., San Francisco, Calif.—lubricated plug—21
Mine & Smelter Supply Co., Denver, Colo.—Inside back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Ohio Brass Co., Mansfield, O.
Oxweld Acetylene Co., New York, N. Y.—4
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Prest-O-Lite Company, New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
Reading Steel Casting Co., Inc., Bridgeport, Conn.—air, oil, steam, water
The P. H. & F. M. Roots Co., Connersville, Ind.
United Lead Co., New York, N. Y.
United States Rubber Co., New York, N. Y.—pump—231
Victor Balata & Textile Belting Co., New York, N. Y.
Worthington Pump & Machy. Corp., New York, N. Y.—exhaust, automatic relief, foot and check, pump

VENTILATING EQUIPMENT

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Graybar Electric Co., New York, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—58-59
The Kirk & Blum Mfg. Co., Cincinnati, O.
Midwest Air Filters, Inc., Bradford, Pa.—299
Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.—50-51
Vulcan Iron Works, Wilkes-Barre, Pa.—mine ventilating fans—89

VIBRATING SCREENS

(See Screens)

WAGONS

Acme Road Machinery Co., Frankfort, N. Y.
Austin-Western Road Mchy. Co., Chicago, Ill.
The Greenville Mfg. Co., Greenville, O.
Miami Trailer Scraper Co., Troy, O.
The Troy Trailer & Wagon Co., Troy, O.
Western Wheeled Scraper Co., Aurora, Ill.—dump—Insert bet. 232-233

WAGON LOADERS

(See Loaders)

WASHERS

Allen Cone Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—sand and gravel—225
Earle C. Bacon, Inc., New York, N. Y.—sand and gravel—275
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Iron Works, Denver, Colo.—sand and gravel
Diester Concentrator Co., Ft. Wayne, Ind.—299
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic—Inside front cover

WASHERS—Cont'd

Dorr Co., New York, N. Y.—56
Eagle Iron Works, Des Moines, Ia.—sand and gravel—305
Galland-Henning Mfg. Co., Milwaukee, Wis.
Good Roads Mchy. Co., Inc., Kennett Square, Pa.—61
Greenville Mfg. Co., Greenville, O.
The Jeffrey Mfg. Co., Columbus, O.—58-59
Lewistown Fdy. & Mach. Co., Lewistown, Pa.—331
Link-Belt Co., Chicago, Ill.—sand and gravel—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—272
Perfect Classifier Co., Nashville, Tenn.—285
J. E. Rhoads & Sons, Philadelphia, Pa.—leather
Roberts and Schaefer Co., Chicago, Ill.—25
Chas. A. Schieren Co., New York, N. Y.—leather
F. L. Smidth & Co., New York, N. Y.—69-70-71
Smith Eng. Works, Milwaukee, Wis.—sand and gravel—283
Stephens-Adamson Mfg. Co., Aurora, Ill.—95
The Stevenson Co., Wellsville, O.—screw
W. Toepfer & Sons Co., Milwaukee, Wis.—288
Traylor Engineering & Mfg. Co., Allentown, Pa.—262-263
Universal Road Mchy. Co., Kingston, N. Y.—300
Webster Mfg. Co., Chicago, Ill.
F. M. Welch Eng. Service, Greenville, O.—289
Weller Mfg. Co., Chicago, Ill.—237

WASHERS (Air)

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Wilwaukee, Wis.
Carrier Air Conditioning Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
The Dust Recovering & Conveying Co., Cleveland, O.
H. Miscampbell, Duluth, Minn.—246-247
Ross Power Equipment Co., Indianapolis, Ind.

WASTE HEAT SYSTEMS

Babcock & Wilcox Co., New York, N. Y.
Edge Moor Iron Co., Edge Moor, Del.—57
Glamorgan Pipe Foundry Co., Lynchburg, Va.—continuous pulp
La Mont Corp., New York, N. Y.—boilers
Wickes Boiler Co., Saginaw, Mich.

WATER SOFTENING SYSTEMS

Chicago Bridge & Iron Works, Chicago, Ill.
Crane Co., Chicago, Ill.
Dearborn Chemical Co., Chicago, Ill.
Ross Power Equipment Co., Indianapolis, Ind.
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Scientific Boiler Chemical Works, Chicago, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

WEIGHING EQUIPMENT

Atlas Car & Mfg. Co., Cleveland, O.—260
Automatic Weighing Mach. Co., New York, N. Y.
Bates Valve Bag Co., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.—60
E. & T. Fairbanks & Co., St. Johnsbury, Vt.
The Fairbanks Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.—Insert bet. 72-73
The Howe Scale Co., Rutland, Vt.
The Komnick Machinery Co., Detroit, Mich.—lime, weighing apparatus—278 and 301
Merrick Scale Mfg. Co., Passaic, N. J.—automatic—296
Richardson Scale Co., Passaic, N. J.—automatic
Schaffer Poidometer Co., Pittsburgh, Pa.—5
Standard Scale & Supply Corp., Pittsburgh, Pa.
Stearns Conveyor Co., Cleveland, O.—automatic conveyors
Valve Bag Co. of America, Toledo, O.—28-29
Western Engineering & Mfg. Co., Chicago, Ill.
Western Valve Bag Co., Chicago, Ill.

WELDING AND CUTTING EQUIPMENT

Aeroil Burner Co., Inc., Union City, N. J.
Air Reduction Sales Co., New York, N. Y.
Allan Mfg. & Welding Corp., Buffalo, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass.—welding tubing
Burke Electric Co., Erie, Pa.
Champion Blower & Forge Co., Lancaster, Pa.
Continental Motors Corp., Detroit, Mich.—arc
O. H. Davidson Equipment Co., Denver, Colo.
Electric Arc Cutting & Welding Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Goodman Mfg. Co., Chicago, Ill.
Haynes Stellite Co., New York, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
The Lincoln Electric Co., Cleveland, O.
The Linde Air Products Co., New York, N. Y.
The MacLeod Co., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—rods—76-77
Metal & Thermit Corp., New York, N. Y.
The Alexander Milburn Co., Baltimore, Md.
The Ohio Brass Co., Mansfield, O.

WELDING & CUTTING EQUIPMENT—Cont'd

Oxweld Acetylene Co., New York, N. Y.—4
Prest-O-Lite Co., Inc., New York, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
H. N. Strait Mfg. Co., Kansas City, Kans.
Universal Oxygen Co., Sheboygan, Wis.
Weldit Acetylene Co., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

WELL DRILLS
(See Drills)

WHEELBARROWS

H. D. Conkey & Co., Mendota, Ill.
The Fairbanks Co., New York, N. Y.
Sterling Wheelbarrow Co., Milwaukee, Wis.

WHEELS (Car)

American Car & Foundry Co., New York, N. Y.
American Manganese Steel Co., Chicago Hts., Ill.
The Atlas Car & Mfg. Co., Cleveland, O.—260
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Pa.
The Buda Co., Harvey, Ill.—cast iron, steel
C. S. Card Iron Works Co., Denver, Colo.
Chrome Steel Works, Carteret, N. J.—74
Dobbie Fdy. & Mch. Co., Niagara Falls, N. Y.
Eagle Iron Works, Des Moines, Ia.—305
Easton Car & Constr. Co., Easton, Pa.—10
Egyptian Iron Works, Murphysboro, Ill.
Enterprise Wheel & Car Corp., Bristol, Tenn.
Farrell-Cheek Steel Fdy. Co., Sandusky, O.—industrial—244
Fuller-Lehigh Co., Fullerton, Pa.—78-79
Griffin Wheel Co., Chicago, Ill.
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Helm Brick Machine Co., Cadillac, Mich.
Joshua Hendy Iron Works, San Francisco, Calif.
Hockensmith Wheel & Mine Car Co., Penns, Pa.
Hill Clutch Mch. & Fdy. Co., Cleveland, O.—302
Kenova Mine Car Co., Kenova, W. Va.
Kensington Steel Co., Chicago, Ill.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—284
Lake Shore Engine Wks., Marquette, Mich.
The Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Lobdell Car Wheel Co., Wilmington, Del.
More-Jones Brass & Metal Co., St. Louis, Mo.
Mullins Body Corp., Salem, O.
Ogden Iron Works, Ogden, Utah
Ottumwa Iron Works, Ottumwa, Ia.
Pennsylvania Casting & Machine Works, Pittsburgh, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.—sheave, car, crane track
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Thaleg & Hock, Chicago, Il.—33
United Iron Works, Inc., Joplin, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.—89
Watt Mining Car Wheel Co., Barnesville, O.

WINCHES AND CAPSTANS

American Car and Fdy. Co., New York, N. Y.
American Hoist & Derrick Co., St. Paul, Minn.—298
Bay City Fdy. & Mch. Co., Bay City, Mich.
Bethlehem Ship Building Corp., Bethlehem, Pa.
W. H. K. Bennett, M. E., Chicago, Ill.
H. W. Caldwell & Sons Co., Chicago, Ill.—303
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Chain & Mfg. Co., Cleveland, O.
Dobbie Fdy. & Mch. Co., Niagara Falls, N. Y.
The Erie Hoist Co., Erie, Pa.—motor truck
S. Flory Mfg. Co., Bangor, Pa.—304
The Hadfield-Penfield Steel Co., Bucyrus, O.—271 and 300
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Joshua Hendy Iron Works, San Francisco, Calif.
The Hill Clutch Mach. & Fdy. Co., Cleveland, O.—302
John T. Horton Co., Inc., New York, N. Y.
Hyman-Michaels Co., Chicago, Ill.
Indiana Foundry Co., Inc., Indiana, Pa.
Ingersoll-Rand Co., New York, N. Y.—Insert bet. 48-49
International Motor Co., New York, N. Y.
Lidgerwood Mfg. Co., New York, N. Y.—64
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manitowoc Eng. Wks., Manitowoc, Wis.—293
Mead-Morrison Mfg. Co., E. Boston, Mass.—motor truck—75
Mining Machine Co., Mountville, Pa.
The Mundy Sales Corp., New York, N. Y.—16
Ottumwa Box Car Loader Co., Ottumwa, Ia.
D. Round & Son, Cleveland, O.

WINCHES AND CAPSTANS—Cont'd

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Sprout, Waldron & Co., Muncy, Pa.—298
Standard Steel Works, North Kansas City, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—hand—95
Superior Iron Works, Superior, Wis.
Thaleg & Hock, Chicago, Ill.—33
Thomas Elevator Co., Chicago, Ill.—299
United Iron Works, Inc., Joplin, Mo.
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Watson-Flagg Eng. Co., Paterson, N. J.—278
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.—237

WIRE CLOTH

American Manganese Steel Co., Chicago Hts., Ill.
American Wire Fabrics Corp., New York, N. Y.
Audubon Wire Cloth Co., Inc., Audubon, N. J.
Buffalo Wire Works Co., Buffalo, N. Y.
Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—289
C. O. Jelliff Mfg. Corp., Southport, Conn.
Robert L. Latimer & Co., Philadelphia, Pa.
Ludlow-Saylor Wire Co., St. Louis, Mo.—Insert bet. 264-265
Manganese Steel Forge Co., Philadelphia, Pa.—76-77
Newark Wire Cloth Co., Newark, N. J.
New Holland Mch. Co., New Holland, Pa.—283
Patterson Fdy. & Mach. Co., East Liverpool, O.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
The W. S. Tyler Co., Cleveland, O.
Wickwire Spencer Steel Corp., New York, N. Y.
G. F. Wright Steel & Wire Co., Worcester, Mass.

WIRE (Welding)

American Steel & Wire Co., Chicago, Ill.—302
Haynes Stellite Co., New York, N. Y.
Oxweld Acetylene Co., New York, N. Y.—4
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233

WIRE (Manganese Steel)

Manganese Steel Forge Co., Philadelphia, Pa.—76-77

WIRE ROPE
(See Rope. Wire)

WIRE ROPE ACCESSORIES

American Cable Co., Inc., New York, N. Y.
American Hoist & Derrick Co., St. Paul, Minn.—298
American Manganese Steel Co., Chicago Hts., Ill.
American Steel & Wire Co., Chicago, Ill.—302
Bourne-Fuller Co., Cleveland, O.—clips—281
Broderick & Bascom Rope Co., St. Louis, Mo.—46
Bucyrus Co., South Milwaukee, Wis.—Insert bet—232-233
H. W. Caldwell & Son Co., Chicago, Ill.—303
Cling Surface Co., Buffalo, N. Y.—preservative
O. H. Davidson Equipment Co., Denver, Colo.
Hazard Mfg. Co., Wilkes-Barre, Pa.
A. Leschen & Sons Co., St. Louis, Mo.—Inside back cover
Link-Belt Co., Chicago, Ill.—Back cover and 42-43
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Jos. T. Ryerson & Son, Inc., Chicago, Ill.
Sauerman Bros., Inc., Chicago, Ill.—256
Sero Specialty Co., Cleveland, O.—cable dressing
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—86

WIRE ROPE SLINGS
(See Slings)

WIRES AND CABLES (Electric)

American Brass Co., Waterbury, Conn.
American Cable Co., Inc., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—302
General Electric Co., Schenectady, N. Y.—Insert bet. 64-65
Graybar Electric Co., New York, N. Y.
Hazard Mfg. Co., Wilkes-Barre, Pa.
John A. Roebling's Sons Co., Trenton, N. J.—Insert bet. 232-233
Standard Underground Cable Co., Pittsburgh, Pa.
United States Rub. Co., New York, N. Y.—231
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—258-259

WORM GEARS
(See Gears)

ZINC SHEETS

New Jersey Zinc Co., New York, N. Y.—corrugated and flat

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Locomotives, Locomotive Cranes, Etc.

1—52-ton 6-wheel American Switcher with separate tender, built 1909, 170 lbs. steam.
1—19x26 in. 6-wheel Porter Switcher with separate tender, built 1919, 180 lbs. steam, ASME Walschaert valve gear.
1—16x24 in. 6-wheel Baldwin switcher, 180 lbs. steam, ASME boiler, built 1917.
3—38-ton 4-wheel saddle tanks, built 1910, 160 lbs. steam, American Locomotive Company.
6—18-ton Porter 36-in. gauge saddle tanks, built 1910-16, 160-70 lbs. steam.
4—18-ton Porter and Vulcan Standard gauge saddle tanks, built 1913-1915, steam 160-65 lbs.
1—32-ton 4-wheel saddle tank, built 1915, steam 180 lbs., ASME boiler.
1—18-ton O. & S. 8-wheel 2-line crane, 40 ft. boom, ASME boiler, built 1920.
1—25-ton Industrial 8-wheel 2-line crane, 50 ft. boom, ASME boiler, built 1914.
1—20-ton Ohio, 50 ft. boom, 8-wheel 2-line, built 1915.

BIRMINGHAM RAIL & LOCOMOTIVE CO.
BIRMINGHAM, ALABAMA

Rails and Cars

Large Stock. Most all sections in new and good serviceable second hand material, ready for immediate shipment. Also frogs and switches, spikes and bolts. Prices cheerfully quoted.

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15 Park Row Bldg., New York. N. Y. — Union Trust Bldg., Pittsburgh. Pa

UNIVERSAL CRUSHER COMPANY
Eastern Agents

All Steel Jaw Crushers. Also used equipment in crushing and power lines.

HOOPER-MOMBERGER CO.
90 West St., New York City Phone Rector 2919

FOR SALE

Crushers—6'x7' Edison Rolls; 5N Gates gyratory.
Draglines—Marion 250—Bucyrus 24; Lidger. B-1½-yd. Sauerman 3-yd., 1-yd.
Pump—10" Morris Mang. New.
Dinkey Baldwin—18-ton, 36" ga.

A. V. KONSBERG
312 S. Clark St. Chicago, Illinois

Crushers

Farrell Jaw, 18"x36", style B.
Telsmith 3-F Reduction.

New Shovel Equipment

1—New Steam Shovel Boom.
1—New Pair Dipper Sticks.
1—New 1 yd. Dipper.

New Drag Scraper Bucket

1—New Hayward 1 yd. capacity, manganese fitted.

Revolving Screen

1—60"x20'. 1—60"x24'.

A. J. O'NEILL COMPANY
Weightman Building Philadelphia, Pa.

FOR SALE

Complete Grinding Unit.
Two 42-in. Fuller Mills.
Cummer Dryer.
Steel Encased Elevators.
Steel Storage Bins, etc.
Will sell as a unit with Steel Building, or any part.
Centrifugal Pumps—2 1000-g.p.m.; 2—1600-g.p.m., steam Turbine Driven.

EDW. W. LAWLER
Metuchen, N. J.

FOR SALE

1—22"x50" and one 26"x50" Champion Jaw Crusher, manganese fitted.
1—30"x64' Return Track Elevator.
1—60"x20' Roller Driven Screen.
1—500 H.P. Corliss Engine.
1—45 to 50 H.P. Otto Full Diesel Oil Engine.
3—No. 5 Champion 11"x26" Jaw Crushers.
1—No. 4½ Champion 10"x20" Jaw Crusher.
3—No. 2½ Climax 10"x20" Jaw Crusher.

CABLE EXCAVATOR COMPANY
Fernwood, Del. Co., Penna.

MACHINERY FOR SALE

ROTARY CRUSHERS
Three No. 0, Three No. 1, One No. 1½, One No. 2 Sturtevant Rotary Fine Crushers, Three No. 0, One No. 1 Sturtevant Ring Roll Mills, One No. 2 Duplex Sturtevant Ring Roll Mill.

GYRATORY CRUSHERS
Two No. 2 Gates and Telsmith, Two No. 3 Gates, Three No. 4 Gates, Two No. 5 Gates, Two No. 6 Gates and McCulley, Two No. 7½ Gates and Austin, Three No. 8 Gates and Traylor, Three No. 9 Gates and McCulley, One No. 12 Gates Gyratory Crusher.

JAW CRUSHERS
One 2"x6", One 3"x7", Two 7½"x13", Two 6"x20", One 10"x15", One 10"x20", Two 12"x24", One 13"x30", One 15"x36", One 18"x36", Two 24"x36", One 36"x48", One 48"x60", One 22"x50".

CRUSHING ROLLS
One 8"x6", Two 16"x10", Three 30"x10", Two 36"x16", Two 42"x16" and One 54"x24" Crushing Rolls.

DRYERS
One 3'x20', Three 4'x30', One 5'x40', One 5½'x 40 , One 6'x60', One 7'x60' and Two 8'x80' Direct Heat Rotary Dryers, One 5'x25', One 6'x30' Ruggles Coles type "A" and One 4'x 20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS
One 4'x40', Two 6'x60', Two 6'x90', One 6'x 100', One 6'x120', One 7½'x80', One 8'x125'.

HARDINGE MILLS
Two 3', Three 4½', Three 6' and Two 8' Hardinge Mills.

SWING HAMMER AND TUBE MILLS
Fuller, Griffin and Raymond Mills, Screens, Air Separators, etc.

THE HEINEKEN ENGINEERING CORP.
Industrial Engineers
95 Liberty St. New York City
Telephone Hanover 2450

For Sale

7½ Gyratory Crusher. Manganese fitted, corrugated head, left angle drive, complete. Good as new.

No. 8 McCully Gyratory Crusher. Smooth Manganese head and concaves. Rear drive. A No. 1 condition.

A-8 (5x30) Ruggles-Coles Dryer. Just like new.

We also have Rotary Kilns, Dryers, Crushers and an exceptional bargain in tube mills.

The Equipment Sales Company
R. W. Storrs, Jr., Manager
Nashville :-: Tennessee

COAL CRUSHING PLANT

1—Standard reciprocating feeder.
1—24"x30" Webster, 2 roll coal crusher.
1—24" belt conveyor.
1—12" bucket elevator, 45'; enclosed.
1—50 ton steel, hopper bottom bin.

J. S. LEWIS
Jonesville Michigan

Caterpillar Steam Shovel

Bucyrus, 14B, ⅔ to ¾-yd. dipper, steam, full revolving, full caterpillar, shop No. 3608. Boiler re-tubed last season, good condition, immediate shipment; suitable for stripping or loading; $2900.

H. Y. SMITH CO., Milwaukee, Wisconsin

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ALL WEIGHTS AND SECTIONS
FROGS—SWITCHES—TIE PLATES

S. W. LINDHEIMER
38 S. Dearborn St. Chicago, Ill.

25-Ton Elec. Locomotive

GYRATORY CRUSHERS
No. 12, 10, 9, 8, 7½, 6, 5, 4, 3
ROLL CRUSHERS
ROLL—84x72, 36x60, 72x30, 18x30
JAW CRUSHERS 60x84
36x48, 22x52, 36x42, 42x40, 20x24, 15x36
DISC CRUSHERS, 48", 36", 24", 18"
25 kw. and ¾ kw., 125 v. Gas Eng. Sets
Shovels—Loco. Cranes
Kilns, Pulverizers, Compressors

ROSS POWER EQUIPMENT CO.
11 South Meridian Street Indianapolis, Ind.

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Two cents a word. Minimum, $1.00 each insertion, payable in advance.

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Cranes:

1—25-ton, 8-wheel, std. gauge, OHIO, Model "E" Locomotive Crane, New 1921, A.S.M.E. boiler; 50 ft. & 70 ft. Boom; Bucket Operating; M.C.B. trucks, Overhauled, Like new;

1—10-ton cat. BROWN HOIST No. 2, full revolving, STEAM, new 1923, ALL STEEL CATERPILLARS, A.S.M.E. boiler, 40-ft. Boom; Bucket operating; First-class condition;

Crawler Shovels:

2—50-B BUCYRUS, full revolving, STEAM, New 1925, ALL STEEL CATERPILLARS; A.S.M.E. boilers, 1¼-yd. Mang. Dippers; HIGH LIFT BOOMS, 30 ft.; DIPPER HANDLES, 21 ft. 6 in.; Slightly used; Like new;

1—P. & H., Model No. 206, full revolving Combination GASOLINE Crawler Shovel & Crane, New 1924, ALL STEEL CATERPILLARS; Waukesha Motor; ¾-yd. mang. Dipper; Boom 18 ft. 6 in; Dipper Handle, 16 ft.; also 38-ft. Crane Boom; Overhauled, Excellent condition.

GREY STEEL PRODUCTS COMPANY
111 Broadway, New York, N. Y.

ATTENTION, GRAVEL, SAND AND STONE PRODUCERS

We have solved one of your biggest problems—that of turning all your idle plant into cash, by either selling, trading or leasing it for you. 6,000 Sand, Gravel and Stone Producers use our services continuously. Send us your problems.

NATIONAL EQUIPMENT CO.
P. O. Box 232, Bloomington, Ind.

FOR SALE

GYRATORY CRUSHERS

2—12K Gates. Real bargains.
1—No. 9 Telsmith, extra heavy. Used 1 season.
2—No. 8 Austins. Manganese fitted.
1—No. 5 Telsmith. Manganese fitted. Used 1 season.
1—No. 4C Telsmith. Manganese concaves.
1—No. 4F Telsmith, reduction. Manganese fitted.
1—No. 4K Gates. Excellent cond.
4—No. 3 Austin, 3D Gates, No. 3 Traylor, reduction.

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Marion 300, 80′ boom, 8 yd. dipper.
3—Bucyrus 95 & 95C. Cats. & RR trucks.
2—Marion 76, RR trucks. A-1 cond.
Osgood 73, Blt. 1917. A-1 cond.
2—Bucyrus 50B caterpillars.
1—Bucyrus 35B. Very low price.

LOCOMOTIVE CRANES

40-Ton Industrial. Blt. 1922. 60′ boom.
30-Ton Industrial. Blt. 1922. Perf. cond.
25-Ton Industrial Prac. new.
25-Ton Browning. Blt. 1925.
3—20-Ton Brownhoists. Blt. 1923.
25-Ton Industrial. Sell or rent.

GAS CAT CRANES AND SHOVELS

104 Northwest. Blt. 1926. Crane.
105 Northwest. Blt. 1925. Crane.
104 Northwest. Blt. 1924. Shovel.
105 Northwest. Blt. 1924. Shovel.
Type O Thew. Blt, 1924. Combination.
206 P & H. Rebuilt. Combination.
Model 10 Byers. Blt. 1923. Except. barg.
Truck Crane on Garford Truck. Comp. overhauled.

MOTORS AND GENERATORS

50-100 HP and 100 KW and larger sizes. Can furnish to suit prac. any condition of service.

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53 W. Jackson Blvd. Chicago, Illinois

NEW—RAILS—RELAY

Pipe, Tanks, Crushers, Cars, Locomotives, Etc.

ZELNICKER IN ST. LOUIS

SPLENDID BARGAIN FOR QUICK ACCEPTANCE

1—4 ft. 6 in. x 20 ft. chilled iron lining Tube Mill, with 8 tons of steel balls. Excellent buy.

Address Box 2115, care of Rock Products
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FOR QUICK SALE

2—6 ft. x 60 ft. Bonnot Rotary Standard Kilns, with driving and supporting mechanism, lining, firing hood but no stack. Make cash offers.

Address Box 2110, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

FOR SALE—CHEAP

One No. 9 Williams Universal Pulverizer.
One 125 H.P. Wicks Boiler.
One 16x20 Chandler and Taylor Engine.
Above in good condition. May be inspected at Marion, Va.

W. F. CULBERT & SONS
Marion, Va.

FOR SALE
CENTRIFUGAL FIRE PUMP

Multi-Stage Underwriter's Centrifugal Fire Pump, built by Allis-Chalmers Mfg. Co. Capacity 1000 gallons per minute. Total head feet 254. 2-stage. R. P. M. 1750. Diameter of suction nozzle 8 inches. Diameter of discharge nozzle 8 inches. Driven by a squirrel cage induction motor with split bearings and moisture proof windings. Normal rated capacity of motor 100 H. P., 440 volts, 60 cycle, 3 phase. Temperature, degrees C., full load, 24 hours, 40 degrees. Potential starter with no voltage release in accordance with Underwrtier specifications. Approximate weight of unit 8000 pounds. Pump has never been used other than to be tested out for two or three minutes every week and is in first class condition.

AMERICAN HOIST & DERRICK CO.
St. Paul, Minn.

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FOR LEASE OR SALE

An extensively opened granite quarry near Atlanta, Ga. Address

GRANITE
517 Grant Building Atlanta, Ga.

FOR SALE

A fine stone quarry, located on the New York Central R. R., ¼ mile of R. R. frontage; 50 acres; about 40 ft. of stone; light stripping; no water to contend with; stone will gravity to top of car on R. R. track.

T. S. BAILEY
Sandy Lake **Pennsylvania**

FOR SALE

Complete stone crushing plant. Twenty (20) acres of limestone; very high in dolomite. Inquire of

HAMILTON BROTHERS
Bellefontaine, Ohio

FLORIDA ROCK PLANT FOR SALE

For immediate sale, up-to-date rock plant less than year old. Twenty-year supply high-grade rock secured. Will pay for itself within two years. Can be seen in operation any time. Always more orders than can fill. $10,500.00 cash. Owner retiring from active business.

Box 2145, care of Rock Products
542 South Dearborn Street Chicago, Illinois

USED EQUIPMENT WANTED

WANTED

7½K, Gates crusher, rear drive.

M. B. S. Co.
Box 49 Greenfield, Mass.

We have a client who is in the market for the machinery and equipment of a complete rock crushing plant—from 60 to 70 tons per hour, for removal to the Pacific coast. Give full particulars, including weights and price. Must be bargain. Also 200 H.P. Electric Hoist. Address

Box No. 2148, care of Rock Products
542 South Dearborn Street Chicago, Illinois

WANTED

Complete concrete road-building outfit for regular Illinois 18′ paving. Will pay cash for right kind of equipment, if priced right. Send complete list, work done with different units and present location.

SCHADT SERVICE COMPANY
Silvis, Illinois

CLASSIFIED ADVERTISEMENTS

POSITIONS WANTED — POSITIONS VACANT
Two cents a word. Minimum, $1.00 each insertion, payable in advance.

INFORMATION
Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, thirty inches to the page.

CLASSIFIED—Displayed or undisplayed. Rate per column inch, $4.00. Unless on contract basis, advertisements must be paid for in advance of insertion.

SITUATIONS WANTED

Mining and Mechanical Engineer Open for Engagement

Experienced in mining and quarrying and in the installation, maintenance and operation of mechanical and electrical equipment. A capable executive with experience in the handling of men. A thoroughly practical man who secured his technical education late in life and who can meet any emergency that is apt to arise. Address

Box 2127, care of Rock Products
542 South Dearborn Street, Chicago, Ill.

POSITION WANTED

General superintendent of quarry operation (open face and underground) will be available January 1. Familiar and well experienced in whole operation of any kind of rock products plant. Experience includes erecting and constructing.

Box 2143, care of Rock Products
542 South Dearborn St. Chicago, Ill.

Executive with broad practical training in Design, Construction, Erection and Operating Wet or Dry Cement Plants. 25 years experience. Have record of efficient results. At present employed as superintendent of wet plant. Can satisfy exacting parties of my reasons for securing employment elsewhere. University graduate, M.E. Highest credentials.

Address Box 2146, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Permanent connection desired by one thoroughly familiar with quarry operation and plant repair. Energetic, dependable, welcomes responsibility and aims to increase production and lower costs. Address

Box 2147, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

POSITION WANTED

General Superintendent has had 19 years of heavy quarry and operating experience; also heavy quarry construction. Practical experience with heavy crushers, electric, gas, and steam power, heavy and light shovel work, either steam or electric, heavy overburden, heavy blasting. Can organize an A-1 organization, good in upkeep and low cost. Best of references. Also experienced in lime production. Address

Box No. 2149, care of Rock Products
542 South Dearborn Street, Chicago, Ill.

To Employers Who Advertise for Men:

These advertisements of "situations open" and "situations wanted" are all bona fide, and in a large majority of cases from firms and men known personally to one or more of the staff of Rock Products.

It sometimes happens, when an employer receives a number of applications for a position open, he neglects to acknowledge some of them.

As a matter of courtesy and good will in our relatively small and closely knit industries, the applicant should receive some acknowledgement. If the employer does not wish to disclose his identity he may make the acknowledgement on plain letter paper.

The applicant is, in practically every instance, a bona fide operating man in the rock products industry. Otherwise he would never see a copy of Rock Products, as it has no circulation outside of those definitely interested in the production of these commodities.

Unless the applicant receives some acknowledgement he does not know that his application forwarded through Rock Products has been properly taken care of or not; and a very good candidate for some future employment is discouraged from answering these blind advertisements, to the detriment of both employer and employe.

Therefore, for the good of all our industry, employers and employes, please treat such applications with the same courtesy you would any other business communication.

—The Publishers.

SITUATIONS VACANT

WANTED

Experienced limestone mine operator. State experience, salary and give full references on application. Address

Box 2138, care of Rock Products
542 South Dearborn Street Chicago, Illinois

WANTED

Foreman for stone crushing plant producing about 60,000 tons of crushed stone annually; plant electric operated; steam shovel for loading in quarry; gasoline locomotives for hauling in quarry. Plant located within 3½ miles of city of 15,000 population. Year around job to right man.

Address Box 2139, care of Rock Products
542 South Dearborn Street Chicago, Ill.

WANTED

Man experienced in quarry and crushed stone operations for the New York market. State full details in letter. Address

Box 2150, care of Rock Products
542 S. Dearborn St., Chicago, Ill.

SITUATION VACANT

New Company expanding in Gypsum field is looking for mill superintendent of large executive ability and with mechanical engineering education and experience. Remarkable opportunity for man of initiative and past success. Give complete information on experience and results. Our own organization knows of this advertisement. Address

Box 2141, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Young man with laboratory experience in gypsum business. Give full information as to experience and salary. Address

Box 2142, care of Rock Products
542 S. Dearborn St. Chicago, Ill.

SUPERINTENDENT WANTED

Must have had experience with Sauerman dragline equipment. State how long and with whom employed; state whether employed at present; state if he can run hoist, and if willing to work. Will pay good salary, state salary wanted at start. Give age and any other points that will be advantageous to employers to know. The plant was built for 10 cars a day. The plant is in New Jersey. A five-room house on deposit may be had free for right man. Address

Box 2144, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

128,210,000 Barrels

is the aggregate annual capacity of prominent cement companies which used ARCOFRAX High Alumina Brick in hot zone linings during the last year.

GENERAL REFRACTORIES COMPANY

117 South 16th Street, Philadelphia, Pa.

DISTRICT OFFICES

Boston Buffalo Chicago Cleveland Detroit Indianapolis New York Pasadena Pittsburgh

Canadian Representative: Webster & Sons, Ltd., Montreal, Canada

WORKS: Baltimore, Md. Beech Creek, Pa. Claysburg, Pa. Danville, Ill. Hitchins, Ky. Joliet, Ill. Karthaus, Pa. Mill Hall, Pa. Mount Union, Pa. Olive Hill, Ky. Orviston, Pa. Rockdale, Ill. Sandy Ridge, Pa. Sproul, Pa. West Decatur, Pa.

Index to Advertisements

A Safeguard for both Men and Profit

"HERCULES"
RED-STRAND WIRE ROPE
REG. U.S. PAT. OFF.

Every wire that goes into "HERCULES" (*Red-Strand*) Wire Rope is first rigidly tested by us to make sure that it meets our exacting requirements. These tests plus our methods of manufacture make a product that gives safe and economical results.

The Wire Rope with the Service Record

Made only by
A. Leschen & Sons Rope Company
Established 1857
5909 Kennerly Avenue
ST. LOUIS
New York—Chicago—Denver—San Francisco

MARCY the famous **ROD MILL**

with the large open end and continuous peripheral discharge.

FOR WET AND DRY GRINDING

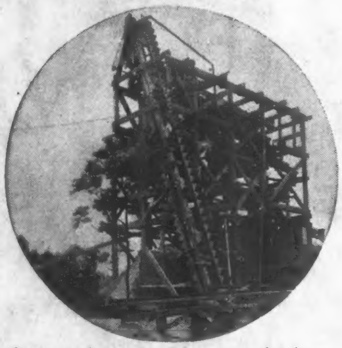
Built to standard, in many sizes, by

The MINE and SMELTER SUPPLY COMPANY
DENVER, COLORADO, U. S. A.
L PASO SALT LAKE CITY NEW YORK

MULTI-WALL, Sewed—MULTI-WALL, Pasted
SINGLE WALL
PAPER BAGS
made from
JAITE PUNCTURE
and
WATERPROOF PAPER
manufactured in uniform quality in our own mill.
Are the strongest bags made.
THE JAITE COMPANY, JAITE, OHIO
WHEN BETTER BAGS ARE MADE JAITE WILL MAKE THEM

Link-Belt Profit Earning Sand and Gravel Washing Plants

Link-Belt Gasoline Crawler Shovel working on stripping job



Bucket elevator raising material from dump hopper to washing plant

Link-Belt Dragline Cableway Excavator coming up with load

SAND and gravel producers in practically all parts of the country are profiting by the economy and efficiency of Link-Belt screening, washing and handling equipment.

Each season thousands of tons of high-grade materials are produced at uniformly lower costs than would be possible without Link-Belt equipment.

Such results are due to the fact that Link-Belt engineers build solidly on the foundation of proved principles, and years of successful experience. The scientific application of these fundamental engineering principles produces the quality and tonnage for which Link-Belt equipped plants are generally known.

Link-Belt equipment for sand and gravel plants is successfully performing every operation, from stripping the overburden to delivering clean sand and gravel to cars for shipment.

Write for a copy of Book No. 540. It has been especially prepared for the sand and gravel industry.

LINK-BELT COMPANY

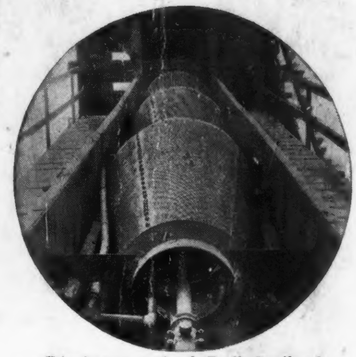
Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

PHILADELPHIA, 2045 Hunting Park Ave.
INDIANAPOLIS, 200 S. Belmont Ave.
CHICAGO, 300 W. Pershing Road

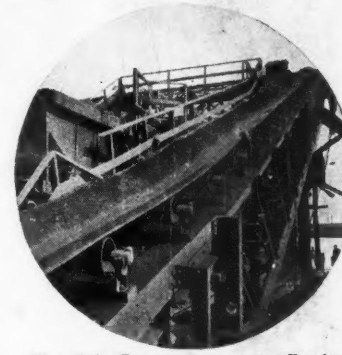
Offices in Principal Cities

LINK-BELT MEESE & GOTTFRIED COMPANY
San Francisco, 19th and Harrison Streets

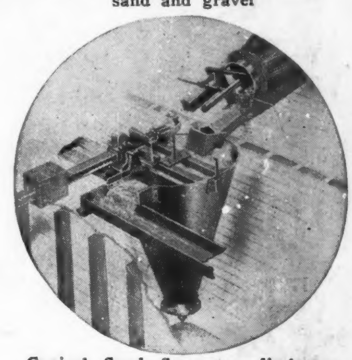
2552



Discharge end of Dull Inclined Conical Screen



The Belt Conveyor — most effective means of conveying raw and washed sand and gravel



Conical Sand Separator discharges washed sand automatically to bin below

General view of H. D. Conkey & Company plant, North Aurora, Illinois

LINK-BELT